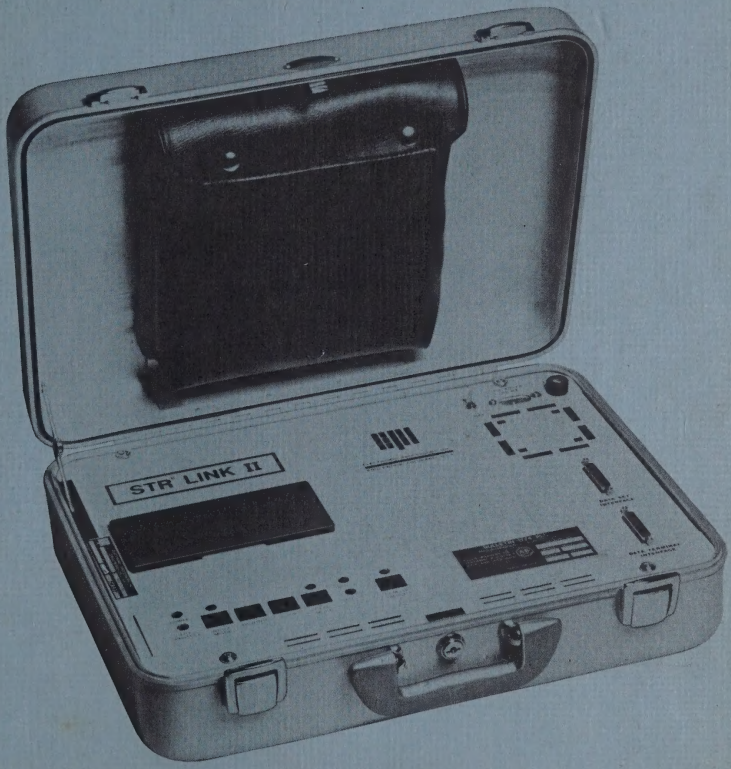
USER'S GUIDE

Digital Cassette Recorder
(Cat. No. 1770-SA)



ALLEN-BRADLEY
Cleveland, Ohio 44143

These quick reference lists are designed to help individuals familiar with the information contained in Sections of this Manual which explain the use of the Digital Cassette Recorder with a specific Allen-Bradley control system.

CAUTION: Do not use these quick reference procedures unless you are familiar with the steps outlined in the Manual. These lists are reduced to a minimum, and, therefore, important operating background information has **not** been included.

REFERENCE LIST FOR BULLETIN 1774 PLC

RECORDING PROGRAMS (any mode)

1 – Set switch on Cable to VERIFY AND RECORD.
2 – Press REWIND.
3 – Press RECORD ON TAPE.

LOADING PROGRAMS (PROG mode only)

1 – Set Mode Select Switch to PROGRAM LOAD.
2 – Set switch on Cable to LOAD.
3 – Press REWIND.
4 – Press READ FROM TAPE.

VERIFYING PROGRAMS (any mode)

1 – Set switch on Cable to VERIFY AND RECORD.
2 – Press REWIND.
3 – Press READ FROM TAPE.

REFERENCE LIST FOR BULLETIN 1772 PLC-2

RECORDING/VERIFYING PROGRAMS (any mode)

1 – On the Recorder press REWIND.
2 – On the Program Panel enter [RECORD] [0].
3 – On the Recorder press RECORD ON TAPE.
4 – On the Recorder press REWIND.
5 – On the Recorder press READ FROM TAPE.

LOADING/VERIFYING PROGRAMS (PROG mode only)

1 – Set the Mode Select Switch to PROG.
2 – On the Recorder press REWIND.
3 – On the Program Panel enter [RECORD] [0].
4 – On the Recorder press READ FROM TAPE.
5 – On the Recorder press REWIND.
6 – On the Recorder press READ FROM TAPE.

VERIFYING PROGRAMS (any mode)

1 – On the Recorder press REWIND.
2 – On the Program Panel enter [RECORD] [1].
3 – On the Recorder press READ FROM TAPE.

REFERENCE LIST FOR BULLETIN 1750 PMC AND BULLETIN 1755 MINI-PMC

RECORDING PROGRAMS (PUNCH mode only)

1 – Set the Panel Mode Switch to PUNCH.
2 – On the Recorder press REWIND.
3 – On the Recorder press RECORD ON TAPE.
4 – When the tape stops, again press RECORD ON TAPE and on the Program Panel press [START].

LOADING PROGRAMS (READER mode only)

1 – Set the PANEL MODE Switch to CLEAR. While holding down [ALTER], press [START].
2 – Set the PANEL MODE Switch to READER.
3 – On the Recorder press REWIND.
4 – On the Program Panel press [START].
5 – On the Recorder press READ FROM TAPE.

VERIFYING PROGRAMS (READER mode only)

1 – On the Recorder press REWIND.
2 – Set the PANEL MODE Switch to READER.
3 – While holding down [ALTER], press [START].
4 – On the Recorder press READ FROM TAPE.

USER'S GUIDE

Digital Cassette Recorder
(Cat. No. 1770-SA)

Because of the variety of uses for this equipment and because of the differences between this solid state equipment and electromechanical equipment, the user of and those responsible for applying this equipment must satisfy themselves as to the acceptability of each application and use of the equipment. In no event will Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

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Section 1
INTRODUCTION

1.0 Introduction – The Digital Cassette Recorder (Cat. No. 1770-SA) [1] is a portable, light-weight recording device which may be used to load user programs into, or record the contents of, memories of the following Allen-Bradley programmable controllers:

- Bulletin 1774, PLC
- Bulletin 1772, PLC-2
- Bulletin 1750, PMC
- Bulletin 1755, Mini-PMC

The Recorder is also capable of carrying on a verification process after the load or record operation. (Refer to Figure 1.)

The Digital Cassette Recorder ordered under Cat. No. 1770-SA consists of the following items:

- 1 Recorder in carrying case
- 1 AC power cord
- 1 Cassette Tape (Cat. No. 1770-XA)
- User's Guide (Publication 1770-800)

The User's Guide is placed in a pocket attached to the inside of the case's cover.

Note: There are many standard Interconnect Cables available for use with the Recorder. The user must specify and order one, as determined by the controller system used in conjunction with the Recorder. (Refer to Table A for the proper Catalog Numbers.)

Additional Cassette Tapes (Cat. No. 1770-XA), or equivalent, may also be ordered separately.

1.1 Recorder – The Recorder is considered a bulk storage device which accesses the contents of a magnetic tape in a sequential manner. The speed of transmission is fixed at 1200 baud, or 120 "characters" per second. The effective speed of operation with a control system is 60 "words" per second. (Each "word" contains 2 "characters," and each character is composed of 1 start bit, 8 data bits, and 1 stop bit.)

The transmission mode is full-duplex, asynchronous bit, serial. Input/output interface, as provided by the two ports on the control panel, follows the Electronics Industries Association RS-232-C standard for data trans-

[1] The Cat. No. 1770-SA was introduced in February, 1978, as a direct replacement for the Cat. No. 1774-T2 Digital Cassette Recorder System, which ceased to be manufactured. Note also that in March, 1978, the Cassette Tape Cat. No. was changed to 1770-XA from 1774-TP.

Figure 1 – Digital Cassette Recorder

Table A
AVAILABLE INTERCONNECT CABLES [1]

TITLE	CAT. NO.	PC SYSTEM
Cassette Recorder Interconnect Cable	1774-TD	Bulletin 1774 PLC
Digital Cassette Recorder Cable	1772-TH	Bulletin 1772 PLC-2
Cassette Tape Cable	1750-TD	Bulletin 1750 PMC Bulletin 1755 Mini-PMC

[1] One must be ordered separately and specified by user when ordering Digital Cassette Recorder.

missions. [2] ("Full-duplex, asynchronous bit, serial" is the transmission of bi-directional exchange of data, through bits, occurring at different times, in sequence, on a single transmission line. A "port" provides access to a data transmission network.)

Push buttons allow for manual activation of 4 functions. (Refer to Figure 2.) These are:

- RECORD ON TAPE
- REWIND
- STOP
- READ FROM TAPE

There is also a REMOTE CONTROL push button that is not presently used with programmable controller systems. It is available for remote control operations that do not require any operator action involving the four functions, noted in the above list.

Individual status indicators provide visual confirmation that certain functions are active and, also, the state of the record/read process. (Refer to Figure 2.) These are:

- POWER ON – This indicator illuminates when power is applied to the Recorder.
- RECORD PROTECT – This indicator illuminates when the Recording Tab on the Cassette Tape is in the NO WRITE position, the cassette is in the transport well, and the RECORD ON TAPE push button is pressed. (Refer to Paragraph 1.2.)
- RECORD ON TAPE – This indicator illuminates when a recording operation is being carried out.
- READ FROM TAPE – This indicator illuminates when a program is being loaded into a controller.
- DATA IN – This indicator illuminates when a recording process is taking place on the Cassette Tape.
- DATA OUT – This indicator illuminates when a "reading" from tape process is in progress.
- REMOTE CONTROL – This indicator illuminates to show that the Recorder has been placed in a mode of operation which allows an external control to command load and read operations. (This is in contrast to push button initiation.)

1.2 Cassette Tape – Allen-Bradley makes available a digital cassette tape which is certified for use in digital cassette recording applications. This is the Cassette Tape (Cat. No. 1770-XA). [3] (Refer to Figure 3.) One track (side) of a Tape has the storage capacity of 92,000 8-bit characters, which is more than adequate for a 12K control program including a Data Table.

---

[2] EIA Standard RS-232-C
EIA Engineering Department
2001 Eye Street, NW
Washington, DC 20006

[3] This item was formerly given Cat. No. 1774-TP.

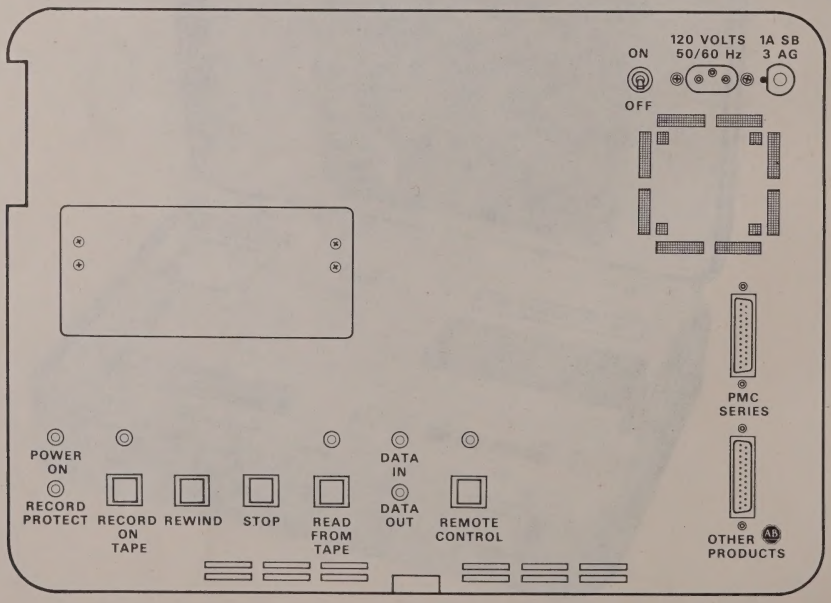


Figure 2 – Control Panel

Equivalent types are acceptable, providing they are certified for Digital Cassette recording.

Figure 3 — Cassette Tape

CAUTION: Do not use tapes of less quality than that specified here. Improper data transfer will result.

Any cassette that is of an acceptable type must be a standard Philips type digital cassette with head pressure pad. Furthermore, it must contain computer-grade magnetic tape specified at 1600 FCI (flux changes per inch). There can be one recording track down on each half of the recording surface, as selected by turning the cassette over.

The Cassette Tape (Cat. No. 1770-XA) offered by Allen-Bradley is manufactured for Information Terminals and identified as T300. It contains a "record protect feature." Each Cassette Tape contains two built-in Recording Tabs on the rear spine of the plastic case. (Refer to Figure 4.) Each lever has 2 positions:

- YES WRITE, which allows recording
- NO WRITE, which blocks recording

The positions are marked on the white name tag. However, they may be also easily distinguished on the basis of being able to see a square hole in the lever bed. When the hole is covered, recording on the tape may be effected. When the hole is visible, data recording is **not** possible. Thus a program may be protected from inadvertent overwriting. Programs, however, may be read from the tape even in the NO WRITE position.

The record protect feature is considered a valuable aid for dependable storage of user programs.

Note that in the Read mode the tape advances and rewinds regardless of the Tab's position. However, no movement takes place in the Record mode when the Recording Tab is set to protect the contents on the tape.

Visual indicators on the control panel aid in determining the position of the Recording Tab when the Cassette Tape is inserted in the Recorder. After the RECORD ON TAPE push button is pressed the DATA IN indicator illuminates if the Recording Tab is set to YES WRITE. If, however, the Tab is set to NO WRITE, the RECORD PROTECT indicator illuminates.

As stated elsewhere in this Publication, two recording tracks are available on the face of the Tape. A user can record on Track A, turn the cassette, and record on Track B. One of the two Recording Tabs corresponds to one of the tracks. Thus one or both tracks may be protected on a given tape.

In order to identify which Tab corresponds to a track, hold the cassette so that the magnetic tape faces you. The Tab at the upper left corresponds to the track that would be recorded should the tape be inserted into the Recorder with this **same** orientation.

Some users, with programs which must be absolutely protected from over writing, have cut the Record Tab off. This is not a recommendation as much as a possibility. However, there is no restoring the track to a YES WRITE mode of operation once the Tab is removed.

Another suggestion that users have found helpful is to keep at least two tape records of proved, operational user programs in separated plant areas and under protected conditions. This assures the most secure back-up. (Refer to Paragraph 5.2 for storage information.)

1.3 Purpose of Recording — Recording is defined as producing a copy of the contents of a memory. The reasons for recording a user program are many:

- Provide a dependable back-up in case the program in memory is inadvertently cleared or altered, or in case a memory must be physically replaced.
- Allow for off-line storage of a number of different programs which may be loaded into the memory when production requirements demand quick change.
- Provide a "source," or valid record, when installation requirements necessitate temporary modifications to the basic program.

WARNING: Never modify a user program for troubleshooting purposes. Unintended machine operation may result.

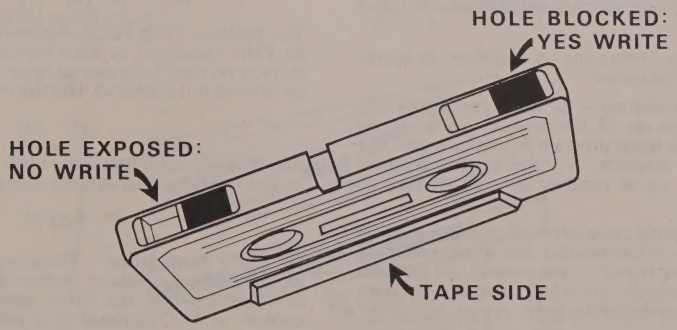


Figure 4 — Recording Tabs

- Allow for transferral of a program to a user-supplied computer so that the program, in conjunction with a Translator Package (PLC, PLC-2, or PMC), may be generated in hardcopy ladder diagram format **with** user device designations immediately above the elements.
- Allow for storage of programs developed off-line on PLC demonstration equipment.
- Allow for user-developed diagnostic programs to be available for immediate use.

> **WARNING:** Diagnostic programs should never be used when the programmable controller is on-line in a RUN mode. Unintended machine motion may occur.

- Allow for the free exchange of programs among installations which may be widely separated geographically, but where applications are identical.

1.3.1 Marking Tapes – When recording programs, users should make use of identification labels in order to identify clearly the following:

- Program identification
- Date, or date **and** time
- Data Table size (for PLC only)
- Parameter Table value (for PLC-2 only)
- Memory requirements in an appropriate form. (Refer to Table B.)

Table B
SUGGESTED MEMORY CAPACITY NOTATIONS [1]

PC TYPE	NOTATION
Bulletin 1774 PLC	4K, 8K, 12K
Bulletin 1772 PLC-2	512, 1024, 1536, 2048 words
Bulletin 1750 PMC	1K
Bulletin 1755 Mini-PMC	1K

[1] Write on Cassette Tape.

Note: At times users return copies of programs to Allen-Bradley for optional Applications Engineering assistance. It is important that the notations, as listed here, be made on the cassettes since individuals not familiar with contents of the tape will need this information prior to working on the programs.

The functions of these notations are explained at appropriate places in this Publication.

1.3.2 Up-to-date Recordings – In order to assure the most convenient back-up of the memory contents, an exact recording of the **latest** program should be made. (By contrast, hardcopy playouts or hand-written program development sheets are as reliable, but not as easy to load.)

Each time the user program is permanently changed, for whatever reason, it is recommended that a new recording be made and correctly noted on the cassette. All previous tape recordings should be erased or written-over since they can only cause confusion later.

It is also recommended that a log book be maintained to record changes to individual programs. (Once the data is modified in the memory, there is no way to recapture it should the need arise.)

1.4 Purpose of Loading – Entire user programs may be loaded into a read/write memory of Allen-Bradley programmable controllers. With the Digital Cassette Recorder, this process may be done quickly any number of times. Identical programs may be loaded into any number of processors which control machines designed to operate in the same manner.

Also, as the result of the "verification" feature built into the programmable controller systems, the contents of memory can be compared to the data on the tape in order to determine whether variations exist. This information may be used as the basis of troubleshooting or debugging.

1.5 Importance of Verification – Throughout this Publication emphasis is placed on the importance of verifying programs. This **is** a necessity, and it is the user's responsibility to carry out the process after recording **or** loading. Since data is transferred from one unit to another, incorrect transmissions may be created. Also, although the specified tape, used in conjunction with the Recorder, has an exceptionally low probability rate of error, the possibility must be anticipated. Procedures outlined here should be followed.

When an error is noted, the user has two alternatives:

- In the case of a load from tape operation, the program may be loaded again and, subsequently, verified. In the case of a record on tape operation, the entire program could be recorded again on the Cassette Tape and then verified.
- In the case of a load from tape operation, an attempt can be made to locate the errors. This involves the use of a Program Panel or Loader.

Obviously, if errors occur during a record on tape operation, the error is assumed to be on the tape. Thus the only practical procedure is to initiate a new record operation.

Note that the comparison process does **not** indicate exactly which storage medium contains the error. The user should determine which program is the "source" and which is the "copy." The user can decide if the medium allows correction (as the read/write memory does) or disallows correction (as the Cassette Tape does).

1.6 END (of program) – All programs that are to be recorded should have an END (of program) statement after the last instruction. The function of this Instruction is to allow for a quicker program scan by the Processor. (Without it, the scan will run to the end of memory, thereby unnecessarily adding time.)

The Bulletin 1774 PLC Processor containing a Program Panel Interface Module with the Cat. No. 1774-TB requires the following be entered:

[↓↑] [3] [7] [7] [1] [7]

The Bulletin 1772 PLC-2 Processor automatically enters an END statement as each instruction is entered. Thus there is no need for a user to write one, although one may be entered if it is desired. Use the instruction:

[↓↑] [3]

The Bulletin 1750 PMC and 1755 Mini-PMC require that an END statement be entered. Use the instruction:

XIO 77

1.7 Early Termination – There may be instances when a load from tape or record on tape operation is accidentally terminated before the entire program is entered or recorded. If this happens, it is necessary to rewind the Cassette Tape to the beginning, and then to begin the whole process again. It is not possible to resume a load or record process at any place on a Tape other than the beginning.

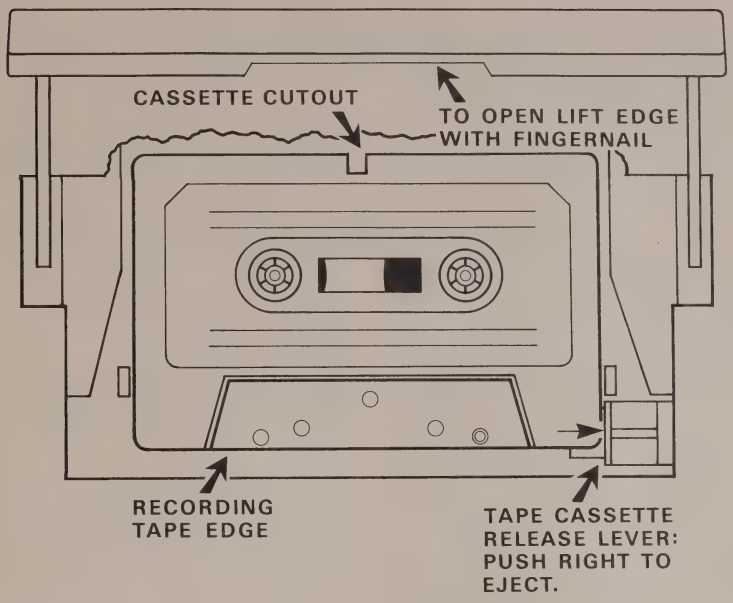


Figure 5 — Inserting a Cassette Properly

1.8 Inserting, Removing Cassette — The Cassette Tape is to be inserted into a well on the Recorder's control panel. During normal operation, or when the Recorder is not in use, the well is covered by a smoked plastic, hinged cover. In order to insert or remove the Cassette Tape, the cover must be hinged up. (Refer to Figure 5.) The following Paragraphs describe how to do this.

1.8.1 Inserting — To insert a Cassette Tape, follow these procedures:

Step 1 — Place a fingernail under the front edge of the plastic cover. Lift. (Refer to Figure 5.) The lid springs open.

Step 2 — Hold the Cassette Tape with the recording tape facing you. (Refer to Figure 6.)

Step 3 — Insert the edge with the cutout into the back of the tape transport well. Seat it firmly in place.

Step 4 — Press the cover down.

Step 5 — Press the REWIND push button.

1.8.2 Removing — To remove a Cassette Tape that is seated in the transport well, follow these procedures:

Step 1 — Lift the smoked plastic cover all the way up.

Step 2 — Reach into the transport well and push the Cassette Tape release lever to the right. This lever is in the right corner of the transport well on the edge nearest the push buttons and indicators. The Cassette Tape pops up and can be removed easily.

1.9 Organization of Manual — This Manual is divided into Sections, each describing the use of the Digital Cassette Recorder with individual controllers. The organization is as follows:

- Section 2 discusses use with the Bulletin 1774 PLC
- Section 3 discusses use with the Bulletin 1772 PLC-2
- Section 4 discusses use with the Bulletin 1750 PMC and 1755 Mini-PMC
- Section 5 contains suggestions for preventive maintenance

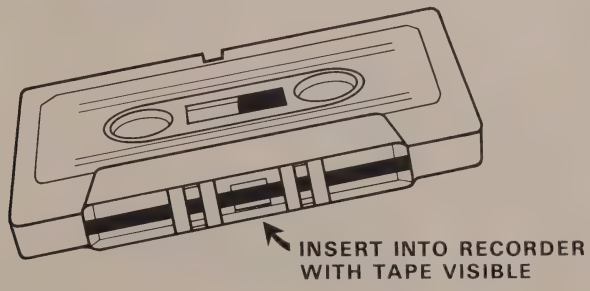


Figure 6 — Cassette Orientation

Section 6 lists specifications for the Recorder

Section 7 is a quick reference list of commands which may be used once a user has a basic understanding of the operation of the Digital Cassette Recorder in relation to the individual controller.

NOTES

Section 2
OPERATION WITH PLC

2.0 Preliminary Steps – Before operating the Digital Cassette Recorder with the PLC System, make the following preliminary steps:

Step 1 – Connect the power cable between the Digital Cassette Recorder and a grounded (3-hole) 120V AC receptacle. (Refer to Figure 7.)

Step 2 – Insert a Cassette Tape (Cat. No. 1770-XA) into the tape transport mechanism.

Step 3 – Set the power ON/OFF switch to the ON position. The POWER ON indicator illuminates when power is on. (Refer to Figure 2.)

Step 4 – If the Processor does not have a Program Panel Interface Module, one must be inserted into the correct slot. (Refer to the label on the inside rear of the Control Panel.)

Step 5 – If the Processor has a Program Panel Interface Module (Cat. No. 1774-TB, -TL, or -TB2), remove the PLC Program Panel Interconnect Cable (if connected). The Cable can be removed from the Module without turning the main power to the Processor OFF. Also, there is no need to turn either the Interlock Bar or Interlock Switch in the Processor to the OFF position.

Lay the Cable aside since it is not needed for this operation.

Step 6 – Set the switch on the connector of the Cassette Recorder Interconnect Cable (Cat. No. 1774-TD) to VERIFY AND RECORD. (Refer to Figure 8.)

Step 7 – Connect the 41-pin connector end of the Cassette Recorder Interconnect Cable to the Program Panel Interface Module. Connect the other end of the Cable to the socket on the Recorder which is labeled OTHER A-B PRODUCTS. (Refer to Figure 2.) For the most trouble-free operation, the slot screws on the connector should be securely fastened into the Recorder.

Again, when connecting or disconnecting the Cable to or from the Program Panel Interface Module, there is no need to turn Processor power OFF.

2.1 Recording Programs – When recording the programs stored in a PLC memory, the Mode Select Switch on the PLC Processor may be in any position. Proceed as follows:

Step 1 – Set the switch on the connector of the Cable to VERIFY AND RECORD.

Step 2 – Verify that the program to be recorded has an END (of Program) statement as the last instruction in the program. This can be visually determined on the Program Panel display screen by entering [SEARCH] [↓] [3] [7] [7] [1] [7] if a Cat. No. 1774-TB Program Panel Interface Module is used. If a Cat. No. 1774-TB2 Module is being used enter a [SEARCH] [RUNG↓]. The END (of Program) will be displayed along with the number of words used in the program.

Step 3 – Press the REWIND push button to make sure that the Cassette Tape is completely rewound. (The recording **must** start at the beginning of the tape.)

Step 4 – When the Tape is completely rewound, press the RECORD ON TAPE push button.

If the Recording Tab is set to the YES WRITE position, the Recorder will operate, and the RECORD ON TAPE indicator illuminates. Then, after a small delay, the DATA IN indicator illuminates, thereby showing that a program is being recorded on tape.

If the Recording Tab is set to the NO WRITE position, the RECORD PROTECT indicator illuminates, but the drive mechanism does not operate, the RECORD ON TAPE indicator does not illuminate, and data is **not** written onto the tape.

Step 5 – When the DATA IN indicator goes OFF and the tape has stopped, the program has been recorded.

In order to cancel the RECORD ON TAPE mode, press either the STOP push button or the REWIND push button. The RECORD ON TAPE indicator goes OFF. (The REWIND push button has no effect if the tape is still in motion.)

Step 6 – After a program has been recorded, it is the

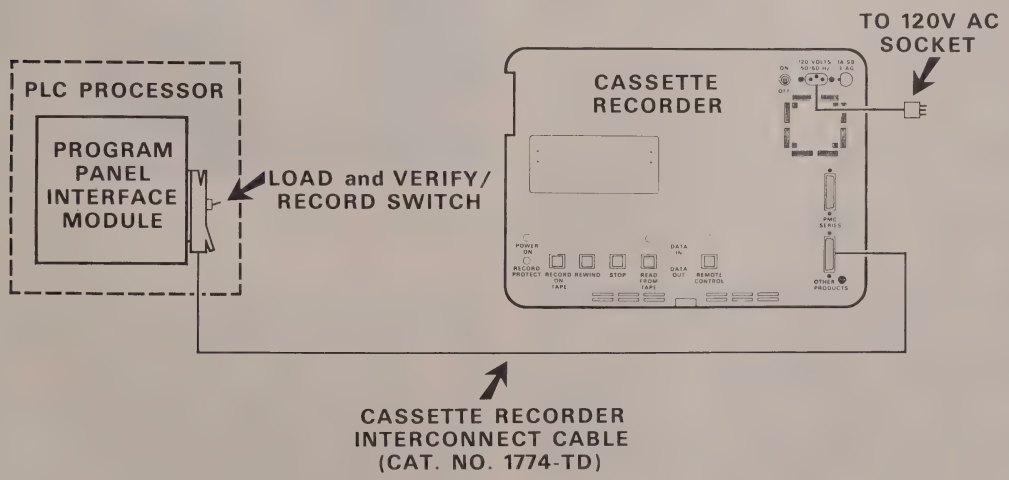

TO 120V AC SOCKET
PLC PROCESSOR
PROGRAM PANEL INTERFACE MODULE
LOAD and VERIFY/ RECORD SWITCH
CASSETTE RECORDER
CASSETTE RECORDER INTERCONNECT CABLE (CAT. NO. 1774-TD)

Figure 7 – PLC, Recorder Connection Diagram

user's responsibility to verify that the data entered on the tape **exactly matches** the data in the PLC memory. Follow the procedure outlined at Paragraph 2.3.

Figure 8 — Cassette Recorder Interconnect Cable

CAUTION: Always verify programs stored on the Cassette Tape. Subsequent unintended operation may result if the two programs are not identical.

Step 7 — The user may protect the program stored on the Cassette Tape by moving the Recording Tab on the Cassette Tape to the NO WRITE position. (Refer to Figure 4 and Paragraph 1.2.)

It is recommended that the Cassette Tape be marked at this point according to the instructions given at Paragraph 1.3.1.

2.2 Loading a Program — To load a recorded program into the PLC memory, proceed as follows:

Step 1 — Determine that the size of the switch-selected Data Table in the PLC memory is at least as large as the Data Table that is to be loaded from the Cassette Tape.

CAUTION: The size of the PLC Data Table must be matched to the Data Table being loaded from the Cassette Tape, or unexpected operation can occur.

In order to determine the size of a Data Table of the user program stored on the Cassette Tape, it is necessary to consult the programmer who wrote the application program. (However, if the suggestions noted at Paragraph 1.3.1 were followed, the Cassette Tape would have this information written on the label.)

In order to determine the Data Table size of the specific PLC memory, determine the Processor Catalog Number from the name plate label on the inside of the Processor's front Control Panel. If the Cat. No. is 1774-LP3, -RP3, or -RP4, follow the procedure outlined in Step 2. If the Cat. No. is 1774-LP1, -LP2, -RP1, or -RP2, follow the procedure outlined in Step 3.

Step 2 — Assuming a Processor with Cat. No. 1774-LP3, -RP3 or -RP4, there are two methods of determining the Data Table size.

First, locate Processor Module No. 1 (Cat. No. 1774-LB2) which is in Slot No. 6 of the Processor. (Refer to the slot assignment label on the inside back of the Control Panel.) On the edge of this Module there is a switch group which contains two rocker switches. Next to it is a label which indicates how the combinations of settings determine the 3 Data Table sizes available: 256, 512, 1024. (Refer to Figure 9.)

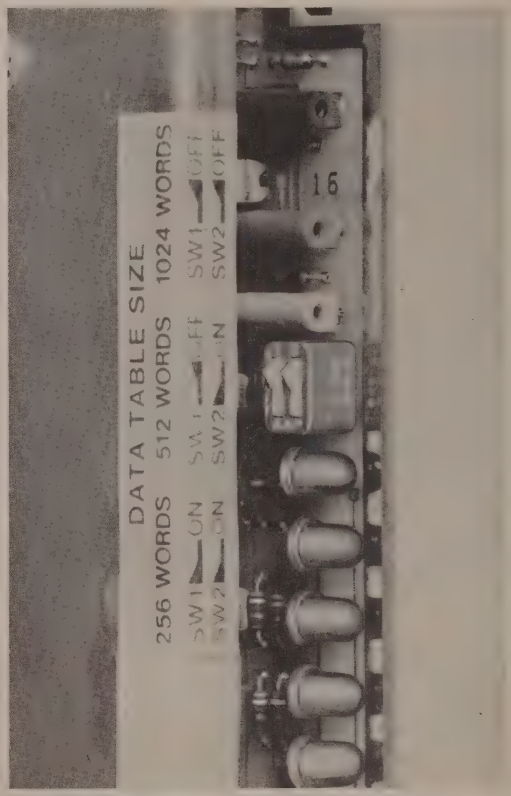


Figure 9 — Cat. No. 1774-LB2 Data Table Switch

Second, connect the Program Panel to the Program Panel Interface Module (Cat. No. 1774-TB2). Press [TTY] [CANCEL COMMAND] [DISPLAY] [RUNG ↑]. The START (of Program) message is displayed. Immediately beneath it, the words DATA TABLE XXXX also appear. (Here XXXX represents the actual size of the Data Table.)

Step 3 — Assuming a Processor with Cat. No. 1774-LP1, -LP2, -RP1, or -RP2, there is a single quick method of determining the Data Table size. Locate Processor Module No. 1 (Cat. No. 1774-LB), which is in Slot No. 4 of the Processor, or the fifth slot from the left. (Refer to the label on the inside back of the Control Panel.) On the edge of this Module there is a switch group which contains

two rocker switches. Next to it is a label which indicates how **both** switches are to be set in order to determine Data Table size. (Refer to Figure 10.)

Figure 10 — Cat. No. 1774-LB Data Table Switch

When both switches are pressed down in the NORM position, a Data Table with 256 words is selected. When both switches are pressed down in the EXPANDED position, a Data Table with 512 words is selected.

Note: There is no visual display of Data Table size when a Program Panel Interface Module (Cat. No. 1774-TB or -TL) is being used.

Step 4 — Determine that the total memory capacity of the specific PLC Processor is large enough to accept the program stored on the Cassette Tape.

CAUTION: Never load a user program into the PLC Processor memory if it exceeds the memory capacity. Improper operation results.

In order to determine the memory capacity of an individual PLC Processor, open the Control Panel door and determine how many Memory Modules (Cat. No. 1774-MA) there are. All Processors must have one. Many have two. Processors with Cat. No. 1774-LP3, -RP3, and -RP4 may have one, two or three. Refer to Table C where capacities are indicated.

Step 5 — Set the Mode Select Switch on the PLC Processor to PROGRAM LOAD.

Table C
PLC MODULE -WORD RELATIONS

MEMORY MODULES	CAPACITY (in words)
1	4096
2	8192
3	12,288

Step 6 — Set the switch on the 41-pin connector of the Cassette Recorder Interconnect Cable to the LOAD position. (Refer to Figure 8.)

Step 7 — Press the REWIND push button on the Recorder to make sure that the Cassette Tape is completely rewound.

Step 8 — Press the READ FROM TAPE push button on the Recorder. Initially the READ FROM TAPE indicator goes ON, but there is no tape motion. During this time the entire PLC memory stored in the Processor is automatically cleared (erased). Then the tape starts running, and, after a brief interval, the DATA OUT indicator illuminates, indicating that data from the tape is being loaded into the PLC Processor.

Step 9 — When the DATA OUT indicator goes OFF and the Tape has stopped, the program has been loaded into PLC memory. In order to cancel READ FROM TAPE mode, press either the STOP or REWIND push button. The READ FROM TAPE indicator then goes off. (The REWIND push button has no effect if the tape is still in motion.)

Step 10 — After a program has been loaded into a PLC memory, verify that the loading was accurate by following the verify procedure provided in Paragraph 2.3.

CAUTION: Always verify all programs loaded into the PLC memory. Subsequent improper operation may result if the two programs are not identical.

2.3 Verifying Programs — After a program has been recorded on tape or has been loaded into a PLC memory from tape, it is important to verify that the recording or loading was accurate.

The verification is actually a comparison process that occurs in the Program Panel Interface Module.

In earlier versions of the Module (Cat. No. 1774-TB, Series B/Revision C, or earlier) in addition to comparing each user program instruction, data files, messages, and preset values of timers and counters are compared for **each** verification.

In later versions of the Module (Cat. No. 1774-TB, Series B/Revision D, or later, or Cat. No. 1774-TB2) although program instructions are always compared, data files, messages, and preset values are **not** compared after the first verification or after these values, through the actual operation of the program, have had the "opportunity" to have changed.

The verification of a user program can occur with the Mode Select Switch on the PLC Processor in any position. However, for the data files, messages, and preset values to be compared the Mode Select Switch must remain in the PROGRAM LOAD position. Proceed as follows:

Step 1 — Set the switch on the 41-pin connector of the Cassette Recorder Interconnect Cable to VERIFY AND RECORD. (Refer to Figure 8.)

Step 2 — Press the REWIND push button on the Recorder to make sure that the Cassette Tape is **completely** rewound.

Step 3 — Press the READ FROM TAPE push button. The READ FROM TAPE indicator illuminates, thereby indicating that the READ mode is selected. Then, after a delay, tape motion begins, and after a few seconds the DATA OUT indicator illuminates, showing that data from the tape is being transmitted to the Program Panel Interface Module.

Step 4 — When the DATA OUT indicator goes off, tape transport motion stops. Verification is complete or the process is terminated early because the maximum number of errors is reached.

Users must examine the ERROR indicator on the Program Panel Interface Module. If it is not illuminated, no errors were discovered. If it is illuminated, at least one error was discovered.

CAUTION: Always examine the ERROR indicator on the Module **before** pressing any push buttons on the Recorder. The indicator stops illuminating when the mode of the Recorder is changed. Thus a new verification would be required to establish whether or not there were errors.

In order to cancel the READ FROM TAPE mode, press either the STOP or REWIND push button. The READ FROM TAPE and ERROR indicators then go off. (Pushing the REWIND push button has no effect if the tape is in motion.)

Step 5 – If a miscomparison is discovered, it is considered an "error." The ERROR indicator on the Program Panel Interface Module illuminates.

The user may terminate the verification, or continue on. When a certain number of errors is detected, tape motion automatically stops. The exact number depends on the specific Interface Module used. (Refer to Table D.)

Since there are two different basic designs of Program Panel Interface Modules, the position of the ERROR indicator on each Module is indicated in Figure 11.

Assuming the verification was allowed to continue even though at least one error was discovered, the DATA OUT indicator will go OFF after the entire program has been compared. However, the ERROR indicator on the Interface Module remains illuminated, assuming no push buttons are pressed on the Recorder. The user should use the ERROR indicator to determine whether or not the verification was successful.

2.4 Searching, Correcting Errors – Errors detected during the verification process may be quickly and conveniently located and displayed with the Program Panel. They appear in the form of a list on the display screen. This list may then be used as the basis for troubleshooting and/or editing. For example:

- Excessive and continuous errors may indicate a malfunctioning Cassette Tape, Recorder, Cable, or Interface Module; that a tape containing an entirely different program is being used; that the Processor's Mode Select Switch is in the TEST-MONITOR or RUN-MONITOR position for verification but operating parameters had been changed when in the PROGRAM LOAD position.
- A user program loaded into memory that has only a few errors may be corrected manually with the Program Panel. This assumes that a hardcopy of the program stored on the Cassette Tape is available. (The value of a manual editing in this case is that it saves loading the program again.)

To search for errors found in the verification process, follow these procedures.

Step 1 – While maintaining power at the Processor, disconnect the Cassette Recorder Interconnect Cable from the Program Panel Interface Module, and connect the Program Panel Interconnect Cable between the Program Panel and the Program Panel Interface Module.

Step 2 – Turn on power to the Program Panel. Allow a short warm-up period.

Step 3 – On the Program Panel keyboard press the [TTY] [CANCEL COMMAND] and [DISPLAY]. At this point the Program Panel is ready for normal operation and the READY message should be displayed.

Step 4 – To display a list of errors, press [SEARCH] and [9]. The Program Panel will then display a listing of 5-digit word addresses corresponding to the errors found during the verification process. The user should make a hand written copy of the list as a quick reference. However the list can be redisplayed at any time prior to turning off Processor main power or initiating a new verification by using the [SEARCH] [9] command.

The exact number of errors that can be listed depends upon the kind of Interface Module and, also, upon the Series level of the Module. Refer to Table D.

If the number of errors discovered in the verification exceeds the number that may be listed by a specific Interface Module, the verification is terminated. The tape stops, the DATA OUT indicator goes off, but the Recorder is still in the WRITE mode. The error indicator on the Interface Module gives the operator a visual indication of the situation.

Note that a complete verification has **not** taken place once the limit of displayed errors is reached.

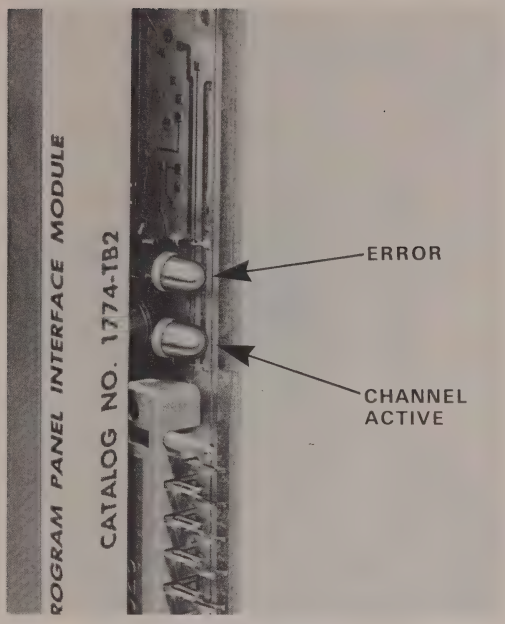
Note that if no errors are found, yet the [SEARCH] [9] command is entered, the message NOT FOUND appears on the Program Panel display screen.

Step 5– To find the specific rung in the program in which an error was detected, press the [CANCEL COMMAND] [SEARCH] and then enter a single 5-digit address repre-

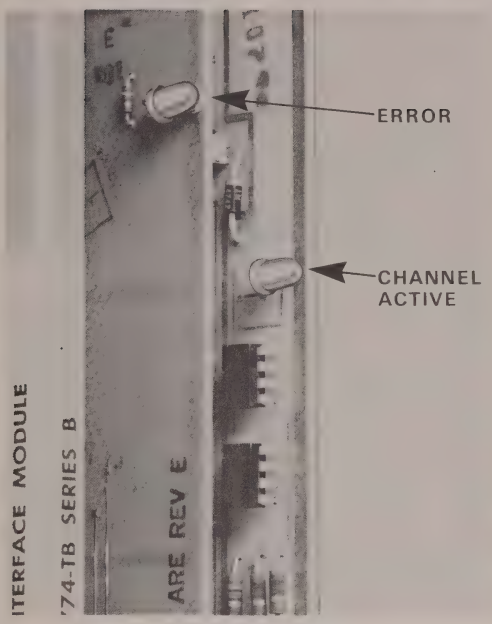
Table D
MODULE-ERROR RELATIONS

NAME	CAT. NO.	SERIES	ERRORS IN LIST
Program Panel Interface Module	1774-TB	A	7
Program Panel Interface Module	1774-TB	B	14
Program Panel Interface Module	1774-TB2	A	14
On-Line Editing Module	1774-TL	A	9

Determine this information by examining label on module. It may also be displayed on the Program Panel by pressing [TTY] [CANCEL COMMAND] [DISPLAY].



(a) Cat. No. 1774-TB2



(b) Cat. No. 1774-TB

Figure 11 — Program Panel Interface Module ERROR Indicator

senting an error from the list displayed. The rung containing the error will be displayed.

If the Mode Select Switch on the Processor is in the PROGRAM LOAD position, the element for which the error was detected appears intensified. At this point editing of the discrepancy can be carried out.

Step 6 — Errors can be corrected, through editing, by referring to a ladder diagram printout of the correct program. The list of errors can be recalled on the display by entering [SEARCH] [9] command at any time until either another verification takes place or power is removed from the Processor. Place the Processor in the PROGRAM LOAD mode to edit the error.

Step 7 — If the user chose to edit errors, he must then initiate a completely new verification process to assure program accuracy.

CAUTION: Even after correcting errors, the user must verify the program again. Errors may still be discovered. Improper operation may result.

2.5 Program Length — When using the Digital Cassette Recorder there may be times when normal user programs are not being loaded into the PLC controller. For example, during training or demonstrations an attempt may be made to write an example—and therefore short—program. This may cause confusion since an excessively short program of about 20 words, or less, is too short for the Processor memory scan requirements. This situation causes two diagnostic indicators on the Processor to illuminate, thereby preventing normal operation. These are:

- The PROCESSOR diagnostic indicator on the Processor's Control Panel illuminates.
- Program Counter Failed indicator on the edge of Processor Module No. 1 (Cat. No. 1774-LB and -LB2) illuminates.

Note that the lower limit of acceptability varies from 20 words downwards, depending on which Processor Module No. 1 is used.

2.6 Summary — Included here is a quick reference summary of commands to be used when operating the Digital Cassette Recorder with a PLC controller.

RECORDING PROGRAMS
(any mode)

1 — Set switch on Cable to VERIFY AND RECORD.
2 — Press REWIND.
3 — Press RECORD ON TAPE.

LOADING PROGRAMS
(PROG mode only)

1 — Set Mode Select Switch to PROGRAM LOAD.
2 — Set switch on Cable to LOAD.
3 — Press REWIND.
4 — Press READ FROM TAPE.

VERIFYING PROGRAMS
(any mode)

1 — Set switch on Cable to VERIFY AND RECORD.
2 — Press REWIND.
3 — Press READ FROM TAPE.

NOTES

DIGITAL CASSETTE RECORDER
(Cat. No. 1770-SA)

INTRODUCTION

The Digital Cassette Recorder (Cat. No. 1770-SA) is a portable, light-weight recording device which may be used to load user programs into, or to record the contents of, memories of Allen-Bradley control system products, including:

- Bulletin 1774, PLC
- Bulletin 1772, PLC-2
- Bulletin 1750, PMC
- Bulletin 1755, Mini-PMC

The Recorder is also capable of carrying on a verification process after the load or record operations. (Refer to Figure 1.)

The Digital Cassette Recorder, ordered under Cat. No. 1770-SA, consists of the following items:

- Recorder in carrying case
- 1 AC power cord
- 1 Cassette Tape (Cat. No. 1770-XA)
- User's Guide Digital Cassette Recorder (Publication 1770-800)

NOTE: There are three standard Interconnect Cables currently available for use with the Recorder. The user must specify and order one, as determined by the control system used in conjunction with the Recorder. (Refer to

[1] The Cat. No. 1770-SA was introduced in February, 1978, as a direct replacement for the Cat. No. 1774-T2 Digital Cassette Recorder System, which ceased to be manufactured. Note also that in March, 1978, the Cassette Tape Cat. No. was changed to 1770-XA from 1774-TP

SPECIFICATIONS [2]

Power Requirements
120V AC (±10%)
60/50 Hz

Baud Rate
1200 Baud

Data Format
8-bit binary, serial
plus 1 start bit and 1 stop bit per character

I/O Interface
EIA RS-232-C

Transmission Mode
Full-Duplex, Asynchronous
Bit Serial

Tape Bit Error Rate [3]
Less than 1 "intermittent" error in 10^7 bits
Less than 1 "unrecoverable" error in 10^8 bits

Tape Recording Density
92,000 8-bit characters
on 1 track of 300-ft. tape

Recording Heads
Dual gap, single track,
Read/write with
separate erase head

Cassette Type
Cat. No. 1770-XA
or equivalent: standard
Philips-type digital cassette
with head pressure pad;
computer grade magnetic
tape certified at 1600 FCI
(flux changes per inch)

Size
6" x 14" x 18"
15.3 cm x 35.6 cm x 45.8 cm
(H x D x W)

Weight
19 lbs. (8.6 kg)

Operating Temperature Range
+10°C to +50°C

Storage Temperature Range
-40°C to +70°C

Humidity Range
5 to 95% R.H.
(without condensation)

Fuse
1A, slo blo 3AG
Bussmann MDL or equivalent

[2] Refers only to models made for Allen-Bradley.

[3] When used in Recorder.

Table A for proper Catalog Numbers. Also, additional Cassette Tapes, Cat. No. 1770-XA, may be ordered separately.)

Table A [1]
AVAILABLE INTERCONNECT CABLES

TITLE	Cat. No.	PC SYSTEM
Cassette Recorder Interconnect Cable	1774-TD	Bulletin 1774 PLC
Digital Cassette Recorder Cable	1772-TH	Bulletin 1772 PLC-2
Cassette Tape Cable	1750-TD	Bulletin 1750 PMC Bulletin 1755 MiniPMC

[1] One must be ordered separately and specified by user when ordering Digital Cassette Recorder.

The Recorder is considered a bulk storage device which accesses the contents of a magnetic tape in a sequential manner. The speed of transmission is fixed at 1200 baud, or 120 "characters" per second. The effective speed of operation with a control system is 60 "words" per second. (Each "word" contains 2 "characters," and each character is composed of 1 start bit, 8 data bits, 1 stop bit.)

DESCRIPTION

Push buttons on the Recorder control panel allow for manual activation of 4 functions. (Refer to Figure 1.) These are:

- RECORD ON TAPE
- REWIND
- STOP
- READ FROM TAPE

There is also a REMOTE CONTROL push button that is currently not used with control systems noted in the first paragraph of this Publication.

Individual status indicators provide visual confirmation that certain functions are active and the state of the record/read process. (Refer to Figure 1.) These are:

- POWER ON
- RECORD PROTECT
- RECORD ON TAPE
- RECORD FROM TAPE
- DATA IN
- DATA OUT
- REMOTE CONTROL

Cassette Tape – Allen-Bradley makes available a Cassette Tape (Cat. No. 1770-XA [2]) which is certified for use in digital cassette recording applications. (Refer to Figure 2.) One track (side) of a Tape has the storage capacity of 92,000 8-bit characters, which is more than adequate for a 12K control program and Data Table.

Equivalent types are acceptable, providing they are certified for digital cassette recording applications.

CAUTION: Do not use tapes of less quality than that specified here. Improper data transfer may result.

Purpose of Recording – Recording is defined as producing a copy of the contents of a memory. The reasons for recording a user program are many:

- Provide a dependable back-up in case the program in memory is inadvertently cleared or altered, or in case a memory must be physically replaced.
- Allow for off-line storage of a number of different programs which may be loaded into the memory when production requirements demand quick change.

[2] This item was formerly given Cat. No. 1774-TP.

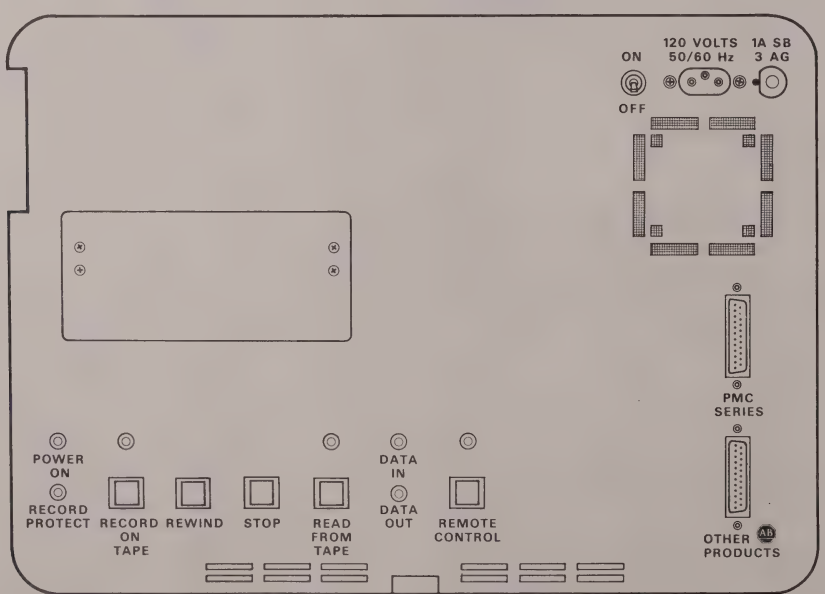


Figure 1 – Control Panel, Digital Cassette Recorder

Figure 2 — Cassette Tape

- Provide a "source," or valid record, when installation requirements necessitate temporary modifications to the basic program.
- Allow for transferring of a program to a user-supplied computer so that the program, in conjunction with a Translator Package (PLC, PLC-2 or PMC), may be generated in hardcopy ladder diagram format **with** user device designations immediately above the elements.
- Allow for storage of programs developed off-line on demonstration equipment.
- Allow for user-developed diagnostic programs to be available for immediate use.
- Allow for the free exchange of programs among installations which may be widely separated geographically, but where applications are identical.

Purpose of Loading — User programs and Data Tables may be loaded into a read/write memory of Allen-Bradley controller systems. With the Digital Cassette Recorder, this process may be done quickly any number of times. Identical programs may be loaded into any number of processors which control machines designed to operate in the same manner.

Also, as the result of the "verification" feature built into the controller systems, the contents of memory can be compared to the data on the tape in order to determine that variations exist. This information may be used as the basis of troubleshooting or debugging.

Importance of Verification — Emphasis is placed on the importance of verifying programs. This is a necessity, and it is the user's responsibility to carry out the process after recording **or** loading. Since data is transferred from one unit to another, incorrect transmissions may be created. Also, although the specified tape, used in conjunction with the Recorder, has an exceptionally low probability rate of error, the possibility must be anticipated.

Additional Documentation — The User's Guide, Digital Cassette Recorder (Publication 1770-800) is supplied as standard with each Recorder. Special operating procedures for each Allen-Bradley programmable controller are described in it. The Manual also contains a maintenance section.

COMPATIBILITY

The Digital Cassette Tape Recorder (Cat. No. 1770-SA) is compatible with all Allen-Bradley controller systems, as specified in the first paragraph of this Publication. It is also functionally compatible with all Bulletin 1774 PLC Processors whatever Cat. No. and with Series 7300 and 7100 numerical controllers. It is also compatible with existing Program Panel Interface Modules having Cat. No. 1774-TB, -TB2, -TL. However, individual differences exist in areas controlled by the Modules. Thus certain procedures or displays may vary to a small degree. These are completely described in the User's Guide.

APPLICATION NOTES

1. When the Digital Cassette Recorder is used with various control systems there may be a need for other optional equipment. For example, when the Recorder is used with the Bulletin 1774 PLC controller, it is necessary to have a Program Panel Interface Module (Cat. No. 1774-TB, -TB2 or -TL) in the Processor. With the Bulletin 1750 PMC and Bulletin 1755 Mini-PMC, it is necessary to also use a Program Loader (Cat. No. 1750-GA).
2. A user program should contain an END (of Program) statement after the last instruction. (Refer to the User's Guide for details.)
3. Users should verify all programs loaded into a memory or recorded from a memory.
4. To assure proper operation, always rewind the Cassette Tape after each operation.
5. The recommended Cassette Tape (Cat. No. 1770-XA) contains Recording Tabs which provide a "record protect" feature. When used, a tape may be protected from being accidentally over-written.
6. Equivalent digital tapes may be used. Specify a standard Philips type digital cassette with head pressure pad. It must be certified for digital cassette applications.
7. One track (side) is capable of storing 92,000 8-bit characters which is in excess of 36K words, and is thus large enough for the maximum user program and Data Table currently usable.
8. Users are encouraged to record the latest program considered acceptable or valid. Each time the memory is modified, a new record should be made. All previous recordings should be erased or over-written to avoid later confusion.
9. Cables from individual programmable controllers must be connected to proper sockets (ports) on the Digital Cassette Recorder. Follow Table B.

Table B
CABLE-SOCKET RELATIONS

PROGRAMMABLE CONTROLLER	SOCKET/PORT
Bulletin 1774 PLC	OTHER A-B PRODUCTS
Bulletin 1772 PLC-2	OTHER A-B PRODUCTS
Bulletin 1750 PMC	PMC SERIES
Bulletin 1755 MiniPMC	PMC SERIES

RECORD PROTECT FEATURE

The Cassette Tape (Cat. No. 1770-XA) offered by Allen-Bradley and manufactured by Information Terminals contains a "record protect feature." Each Cassette Tape contains two built-in Recording Tabs on the rear spine of the plastic case. (Refer to Figure 3.) Each lever has 2 positions:

- YES WRITE, which allows recording
- NO WRITE, which blocks recording

The positions are marked on the white name tag. However they may be also easily distinguished on the basis of being able to see a square hole in the lever bed. When the hole is covered, recording on the tape may be effected. When the hole is visible, data recording is not possible. Thus a program may be protected from inadvertent over-writing. Programs, however, may be read from the tape even in the NO WRITE position.

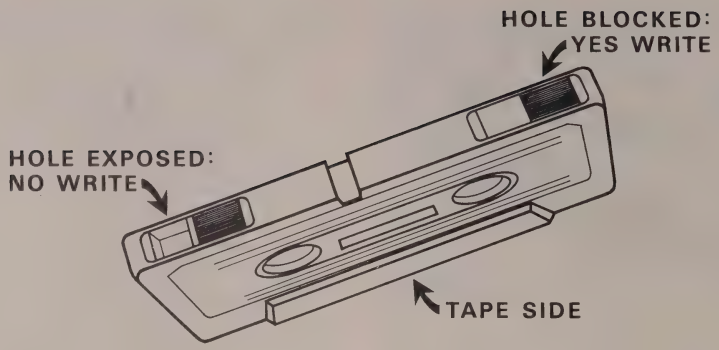


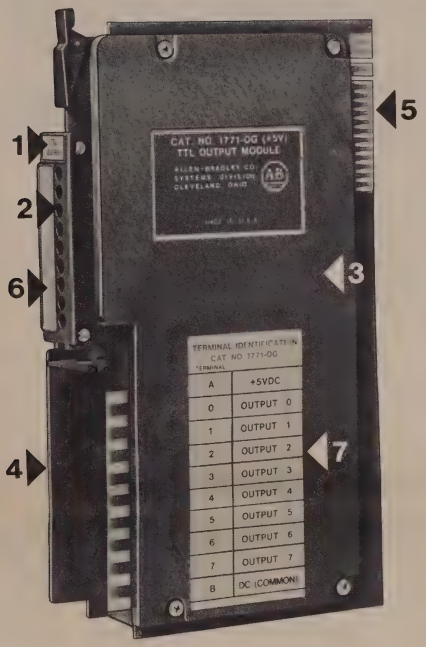
Figure 3 — Recording Tabs

The file protect feature is considered a valuable aid for dependable storage of user programs.

Two recording tracks are available on the face of the tape. A user can record on Track A, flip the cassette, and record on the Track B. One of the two Recording Tabs corresponds to one of the tracks. Thus one or both tracks may be protected on a given tape.

ALLEN-BRADLEY
Cleveland, Ohio 44143

TTL OUTPUT MODULE ASSEMBLY
Cat. No. 1771-OG



1. Gray identification label
2. Status indicators
3. Protective covers
4. Field Wiring Arm connects here
5. Slotted for I/O insertion only
6. Space for user output labeling
7. Label identifies terminal connections

DESCRIPTION

The TTL Output Module Assembly (Cat. No. 1771-OG) provides 8 transistor-transistor logic (TTL) compatible outputs for interfacing with discrete or integrated circuit TTL devices, LED displays, and various other 5V DC devices.

The TTL Output Module Assembly (Cat. No. 1771-OG) includes the following items:

- TTL Output Module (Cat. No. 1771-OGC)
- Field Wiring Arm (Cat. No. 1771-WC)

User wiring connections are made to the Field Wiring Arm. The Wiring Arm, acting as a terminal strip, pivots on the I/O Chassis to connect with terminals on the front of the Module. The Wiring Arm allows the Module to be removed from the Chassis without the need to disconnect terminal wiring.

Module logic circuitry is provided 1500V opto-electrical isolation from Module TTL output circuitry.

SPECIFICATIONS

TTL Compatible Outputs per Module
8

Output Voltage Rating
HIGH = TRUE (Switch No. 1 ON) [1]

	MIN	MAX
ON	2.4V DC	5.25V DC
OFF	-0.2V DC	+0.4V DC

LOW = TRUE (Switch No. 1 OFF) [1]

	MIN	MAX
ON	-0.2V DC	+0.4V DC
OFF	2.4V DC	5.25V DC

Output Current Rating
20 mA (max.) sink current
1 mA (max.) source current

Customer Supply Voltage
5V DC (±0.25V)
50 mV p-p ripple (max.)

Customer Current Required
250 mA per Module

Slew Rate [2]
1 - 4 volts/μsec
at 5V DC levels

Power Supply 5V Current Requirements
131 mA (typical)
168 mA (max.) [3]

Opto-Electrical Isolation
1500V
Isolation between input and control circuits

Cable
Belden 8761
or equivalent

Ambient Temperature Rating
0°to 60°C (operational)
-40°to 85°C (storage)

Humidity Rating
5% to 95%
(without condensation)

Module Location
I/O Rack

Keying
Modules are slotted for placement in I/O slots only

[1] Refer to LOGIC LEVELS.
[2] Exact value depends on customer circuitry.
[3] Refer to POWER SUPPLY REQUIREMENTS.

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LOGIC LEVELS

TTL-compatible devices have only one of 2 well-defined voltage levels at a given instant. Each voltage level corresponds to a distinct binary logic state: 1 or 0. A logic "1" voltage may also be termed TRUE or ON. A logic "0" voltage may also be termed FALSE or OFF.

The TTL Output Module allows switch-selection of one of 2 levels:

- HIGH = TRUE logic
- LOW = TRUE logic

The output voltage range for each logic selection is listed in Table A.

TABLE A

Bit, Device Status for HIGH and LOW = TRUE Logic [1]

MEMORY BIT STATUS	DEVICE STATUS	
	HIGH = TRUE	LOW = TRUE
"1"	ON State Considered:	
	2.4V to 5.25V DC	-0.2V to +0.4V DC
"0"	OFF State Considered:	
	-0.2V to +0.4V DC	2.4V to 5.25V DC

[1] Refer to Figure 2.

PROGRAMMING

Each output may be controlled by the following Instructions:

Energize output device at addressed terminal (non-retentive)

Latch output device ON at addressed terminal (retentive)

Unlatch output device at addressed terminal (retentive)

PUT — Transfer status of 16 bits (1 word) to a location in memory specified (retentive)

In the Output Image Table of controller memory, a single bit controls each TTL Output Module output terminal. As the controller Processor executes the user program, it sets or resets the logic state of this bit. This logic state, as a "1" or "0", is transmitted to the output terminal of the TTL Output Module.

The **voltage** which appears at the module terminal depends on **both** the "1" or "0" state of the memory bit **and** the user switch selection. Table A shows the voltage range for each user selection. For HIGH = TRUE logic, the voltage range for an ON or logical "1" state is 2.4V to 5.25V DC. The voltage range for an OFF or logical "0" state is -0.2V to +0.4V DC.

When LOW = TRUE logic is selected, the voltage range for an ON or logical "1" state is -0.2V to +0.4V DC. The voltage range for an OFF or logical "0" state is 2.4V to 5.25V DC.

For a complete description of the programmable controller memory, refer to the Publications listed in Table B.

TABLE B - Publications on Memory Structure

PROCESSOR	CAT. NO.	PUBLICATION
PLC Processor	1774-RP3, -RP4 1774-RP1, -RP2	1774-934 1774-921
PLC-2 Processor	1772-LP1, Series A 1772-LR, Series B 1772-LR, Series A	1772-909 1772-907 1774-921
PLC-2 Mini-Processor Module	1772-LN1, -LN2	1772-700

STATUS INDICATORS

There are 9 status indicators on the front of the Module. (Refer to Figure 1.) Each of the lower 8 indicators illuminates when its corresponding output terminal is in the TRUE or logic "1" state. Because the voltage level for a logic state is switch-selectable, the indicator illuminates at a high voltage when HIGH = TRUE logic is selected, at a low voltage when LOW = TRUE logic is selected.

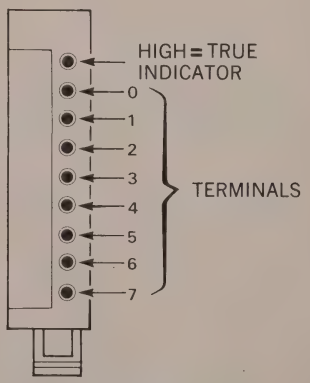


FIGURE 1 - Status Indicators

These status indicators are useful for diagnostic purposes. Based on the user Logic State Switch selection, each indicator illuminates when its corresponding output

terminal is ON, TRUE, or at a logic "1". As Table A indicates, this voltage must be between 2.4V and 5.25V DC when HIGH = TRUE logic has been selected. This voltage is between–0.2V and+0.4V DC when LOW=TRUE logic is selected.

Status indicators may appear dim during rapid pulsing of the output signal.

The top indicator is labeled HIGH=TRUE. This indicator is ON when HIGH=TRUE logic is selected and Switch No. 2 on the Switch Assembly is ON. Should it be necessary, this indicator may be disabled by turning Switch No. 2 on the Switch Assembly to the OFF position. (No separate logic indicator is provided for LOW=TRUE operation.)

SWITCH SELECTION

Figure 2 shows the settings of the TTL Logic Level Switch Assembly on the Module. These rocker switches are to be set by the user prior to installation of the Module in the Chassis.

The TTL Logic Level Switch Assembly is located on the component side of the Module circuit board, near the output terminals. The Module cover must be removed to expose the Switch Assembly. Four screws hold this plastic cover to the Module at its corners.

POWER SUPPLY REQUIREMENTS

CAUTION: Misapplication of AC voltage or application of reverse DC voltage can cause a failure or damage the output circuitry of the Module.

For the TTL **output** circuitry of the Module, a customer-supplied 5V DC power source is connected to the Wiring Arm of the Module. This source must be capable of providing 250 mA to each TTL Output Module. (The use of this separate source is required to provide electrical isolation between Module logic circuitry and the user's TTL devices.)

The **logic** circuitry of the TTL Output Module is powered by the PLC, PLC-2, or Bulletin 1771 Power Supply which connects to the I/O Chassis. The +5V DC current drawn from this Supply by the TTL Output Module depends on the number of outputs that are ON at a specific time. The term "ON" means that the output is considered at a TRUE state for the type of logic selected. (Note that this refers not only to the high or low voltage level at the output, but also to the logic level switch selection made by the user.)

CONNECTIONS

CAUTION: Power must be removed from the Module before it is placed into, or removed from, the I/O Chassis. This means that **both** power from the Power Supply connected to the I/O Chassis and power from the user-supplied 5V DC source must be turned OFF. Failure to observe this caution can result in damage to the module.

Connection of user TTL output devices to the Module's Field Wiring Arm is made using Belden No. 8761 or equivalent cable. Follow the Connection Diagram in this Publication.

This cable has a foil shield with a bare stranded drain wire. These are to be grounded at one end of the cable only. The best ground for this connection is usually the enclosure ground at an I/O Chassis mounting bolt or stud. At the other end of the cable, which connects to the user device, the shield is cut short and taped back to prevent it from making electrical contact.

To ground the shield at the I/O Chassis end, carefully remove a length of cable jacket and pull back the foil shield from the insulated wires. Twist this shield and bare stranded drain wire together to form a single strand. Clip the insulated wires to extend no more than 2 inches beyond the cable jacket and make connection to the appropriate Wiring Arm terminals. Then, fold the shield back and route it to the Chassis ground. (Refer to Figure 3.)

The single ground at the Chassis is the only electrical contact of the shield. Where necessary, use electrical tape to insulate the shield from any other contact.

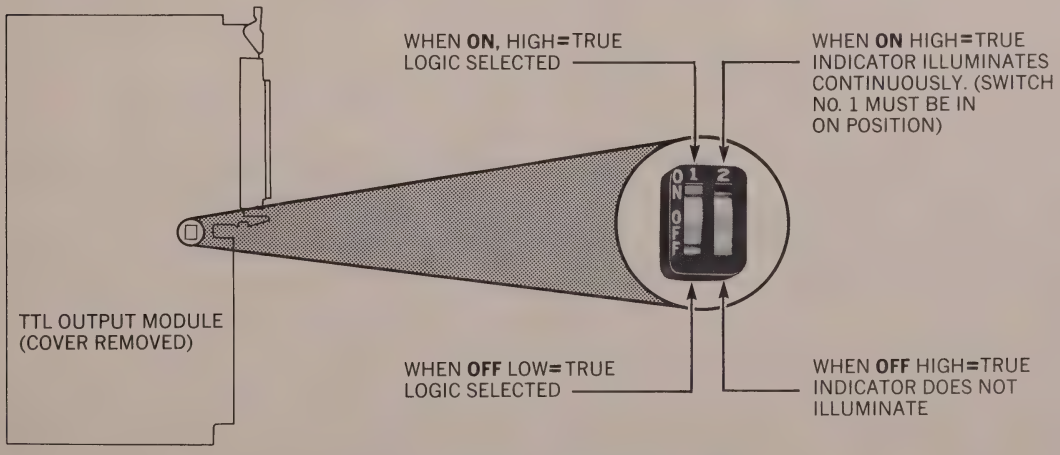
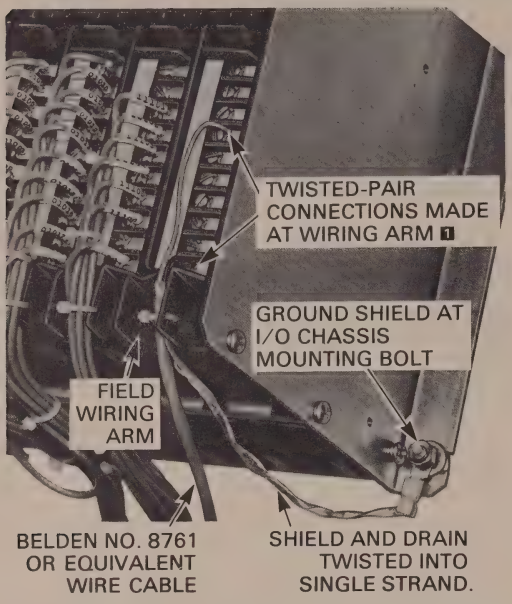


FIGURE 2 - TTL Logic Level Switch Assembly


TWISTED-PAIR CONNECTIONS MADE AT WIRING ARM 1
GROUND SHIELD AT I/O CHASSIS MOUNTING BOLT
FIELD WIRING ARM
BELDEN NO. 8761 OR EQUIVALENT WIRE CABLE
SHIELD AND DRAIN TWISTED INTO SINGLE STRAND.

1 Refer to individual I/O Module Data Sheets for exact twisted-pair terminal connections.

FIGURE 3 - Cable Shield Grounding

The recommended maximum cable length is 50 feet.

The signal ground return wire of each transmission cable must be connected to the user power supply DC common at **both** transmitting and receiving ends. (Do not confuse this connection with the practices for shield grounding, as outlined here. Refer to the Connection Diagram.)

A reverse-biased Schottky diode can be used to limit negative overshoot at the receiving end. A Schmitt trigger input may be used to increase noise immunity when located near user TTL circuitry.

Customer-supplied gates used as receivers should have all inputs tied to the signal line. A single gate should be used as the termination of a signal line. Avoid using other logic inputs to the receiving gate.

Source current is provided on the Module through a pull-up resistor to the +5V DC line.

Output terminals of the TTL Output Module (Cat. No. 1771-OGC) may directly drive terminals of the TTL Input Module (Cat. No. 1771-IGC). Connect the cable shield between modules at one end only.

KEYING

In initial design stages, the TTL Output Module may be inserted into any I/O module slot of the I/O Chassis. However, once specific slots have been designated for a module, care should be taken so that other types of modules will not be mistakenly placed into these slots. Plastic keying bands, shipped with each I/O Chassis, provide an easy method for the user to key an I/O slot to accept only one type of I/O module. Use of these keying bands is strongly recommended.

Each type of I/O module is slotted in two places at its rear edge. The position of the keying bands on the backplane connector must correspond to these slots to allow insertion of the module. Any I/O Rack connector may be keyed solely to receive the TTL Output Module (Cat. No. 1771-OG).

For the TTL Output Module, position keying bands on the upper backplane connector between these numbers printed on the backplane:

- Between 6 and 8
- Between 10 and 12

Refer to Figure 4.

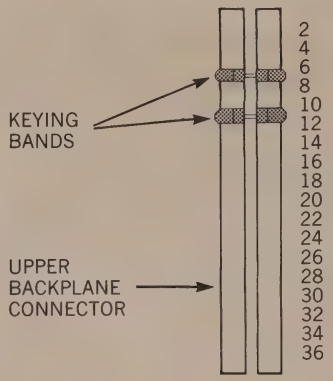
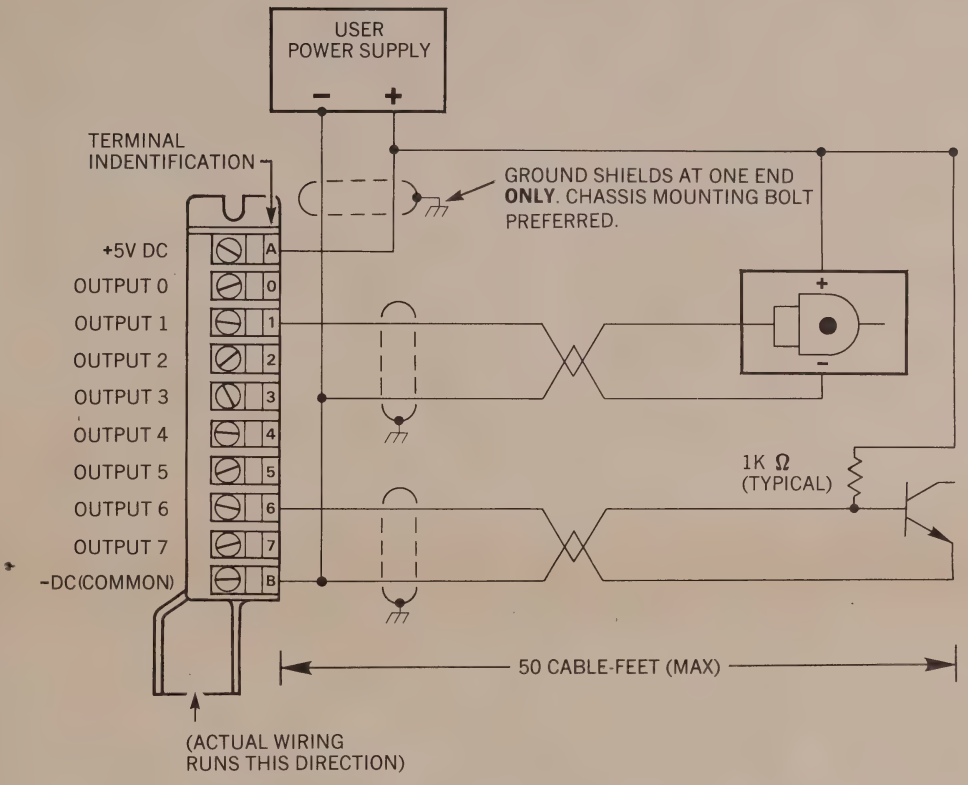


FIGURE 4 - Keying Diagram

The position of these bands may be changed by the user if subsequent system design and rewiring make insertion of a different type of module necessary.

Needle-nose pliers may be used to insert or remove keying bands.

CONNECTION DIAGRAM
(See applicable codes and laws)



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P/N 636028-50

DEFIANCE
14 MEMBERS
0 CHANGE

4 NETS
0 DRILLS
0 HOURS
1 PSE
100 HOURS GOBA
1 EMERGENCY OP
96 HOURS
~~24~~ 12 PRESS OPS
212 HOURS

ACCON
40
0 CHAIRS
8 NETS
26 HOURS

VAN WERT
17
0
6
28

STEVE + BARRI
RESTERAUNT

CLEVELAND
DAVE + BOSTECS

75, 5, 110, 155

154 0866-00

TCK 2235

TARPS TENT SHADE SOUND BOARD

CHRIS 937 492 8031 SOUND ADVICE

12'x12'
196
16

8 PAR ~~CAN~~ HEADS 500 WATTS THEATER LIGHTING
1 FOCAC SPOT w/ GOBO
SPARKLE LIGHT
IWW

SEEKERS OF LOST SOULS.COM

PKA TE RELAY

K6 POWER SUPPLY

JAY SPIVACK

PJPILOT@AOL.COM

1250
750
2000

500 N
300 S
400 V
500 C
1700

PROTECTOR
SUBWOOFER SOUNDS

5000
3700
1300

120

300

80 22 LBS

100.00
50.

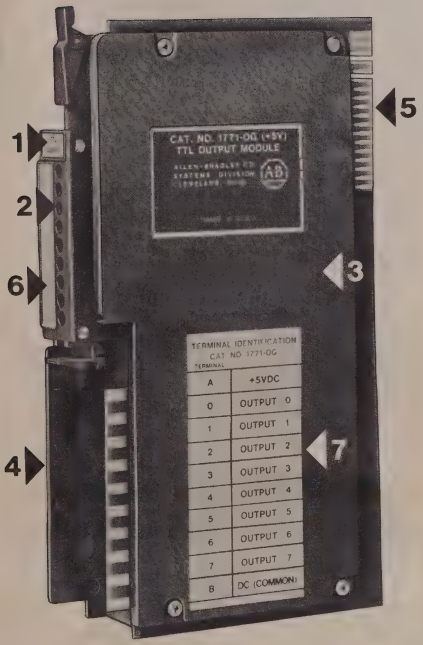
430.00

HOME CITY ICE

BUCYRUS PICK UP
ICE

TDMA 1000

TTL OUTPUT MODULE ASSEMBLY
Cat. No. 1771-OG



1. Gray identification label
2. Status indicators
3. Protective covers
4. Field Wiring Arm connects here
5. Slotted for I/O insertion only
6. Space for user output labeling
7. Label identifies terminal connections

DESCRIPTION

The TTL Output Module Assembly (Cat. No. 1771-OG) provides 8 transistor-transistor logic (TTL) compatible outputs for interfacing with discrete or integrated circuit TTL devices, LED displays, and various other 5V DC devices.

The TTL Output Module Assembly (Cat. No. 1771-OG) includes the following items:

- TTL Output Module (Cat. No. 1771-OGC)
- Field Wiring Arm (Cat. No. 1771-WC)

User wiring connections are made to the Field Wiring Arm. The Wiring Arm, acting as a terminal strip, pivots on the I/O Chassis to connect with terminals on the front of the Module. The Wiring Arm allows the Module to be removed from the Chassis without the need to disconnect terminal wiring.

Module logic circuitry is provided 1500V opto-electrical isolation from Module TTL output circuitry.

SPECIFICATIONS

TTL Compatible Outputs per Module
8

Output Voltage Rating
HIGH = TRUE (Switch No. 1 ON) [1]

	MIN	MAX
ON	2.4V DC	5.25V DC
OFF	-0.2V DC	+0.4V DC

LOW = TRUE (Switch No. 1 OFF) [1]

	MIN	MAX
ON	-0.2V DC	+0.4V DC
OFF	2.4V DC	5.25V DC

Output Current Rating
20 mA (max.) sink current
1 mA (max.) source current

Customer Supply Voltage
5V DC (±0.25V)
50 mV p-p ripple (max.)

Customer Current Required
250 mA per Module

Slew Rate [2]
1 - 4 volts/μsec
at 5V DC levels

Power Supply 5V Current Requirements
131 mA (typical)
168 mA (max.) [3]

Opto-Electrical Isolation
1500V
Isolation between input and control circuits

Cable
Belden 8761
or equivalent

Ambient Temperature Rating
0°to 60°C (operational)
-40°to 85°C (storage)

Humidity Rating
5% to 95%
(without condensation)

Module Location
I/O Rack

Keying
Modules are slotted for placement in I/O slots only

[1] Refer to LOGIC LEVELS.
[2] Exact value depends on customer circuitry.
[3] Refer to POWER SUPPLY REQUIREMENTS.

Publication 1771-914 — January, 1980

LOGIC LEVELS

TTL-compatible devices have only one of 2 well-defined voltage levels at a given instant. Each voltage level corresponds to a distinct binary logic state: 1 or 0. A logic "1" voltage may also be termed TRUE or ON. A logic "0" voltage may also be termed FALSE or OFF.

The TTL Output Module allows switch-selection of one of 2 levels:

- HIGH = TRUE logic
- LOW = TRUE logic

The output voltage range for each logic selection is listed in Table A.

TABLE A
Bit, Device Status for HIGH and LOW = TRUE Logic [1]

MEMORY BIT STATUS	DEVICE STATUS	
	HIGH = TRUE	LOW = TRUE
"1"	ON State Considered:	
	2.4V to 5.25V DC	-0.2V to +0.4V DC
"0"	OFF State Considered:	
	-0.2V to +0.4V DC	2.4V to 5.25V DC

[1] Refer to Figure 2.

PROGRAMMING

Each output may be controlled by the following Instructions:

Energize output device at addressed terminal (non-retentive)

Latch output device ON at addressed terminal (retentive)

Unlatch output device at addressed terminal (retentive)

PUT — Transfer status of 16 bits (1 word) to a location in memory specified (retentive)

In the Output Image Table of controller memory, a single bit controls each TTL Output Module output terminal. As the controller Processor executes the user program, it sets or resets the logic state of this bit. This logic state, as a "1" or "0", is transmitted to the output terminal of the TTL Output Module.

The **voltage** which appears at the module terminal depends on **both** the "1" or "0" state of the memory bit **and** the user switch selection. Table A shows the voltage range for each user selection. For HIGH = TRUE logic, the voltage range for an ON or logical "1" state is 2.4V to 5.25V DC. The voltage range for an OFF or logical "0" state is -0.2V to +0.4V DC.

When LOW = TRUE logic is selected, the voltage range for an ON or logical "1" state is -0.2V to +0.4V DC. The voltage range for an OFF or logical "0" state is 2.4V to 5.25V DC.

For a complete description of the programmable controller memory, refer to the Publications listed in Table B.

TABLE B - Publications on Memory Structure

PROCESSOR	CAT. NO.	PUBLICATION
PLC Processor	1774-RP3, -RP4 1774-RP1, -RP2	1774-934 1774-921
PLC-2 Processor	1772-LP1, Series A 1772-LR, Series B 1772-LR, Series A	1772-909 1772-907 1774-921
PLC-2 Mini-Processor Module	1772-LN1, -LN2	1772-700

STATUS INDICATORS

There are 9 status indicators on the front of the Module. (Refer to Figure 1.) Each of the lower 8 indicators illuminates when its corresponding output terminal is in the TRUE or logic "1" state. Because the voltage level for a logic state is switch-selectable, the indicator illuminates at a high voltage when HIGH = TRUE logic is selected, at a low voltage when LOW = TRUE logic is selected.

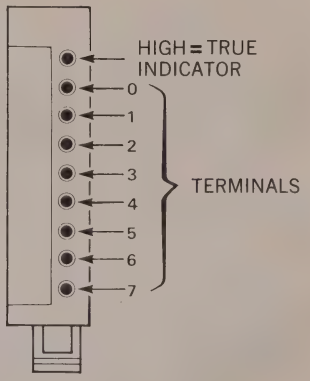


FIGURE 1 - Status Indicators

These status indicators are useful for diagnostic purposes. Based on the user Logic State Switch selection, each indicator illuminates when its corresponding output

terminal is ON, TRUE, or at a logic "1". As Table A indicates, this voltage must be between 2.4V and 5.25V DC when HIGH = TRUE logic has been selected. This voltage is between–0.2V and+0.4V DC when LOW=TRUE logic is selected.

Status indicators may appear dim during rapid pulsing of the output signal.

The top indicator is labeled HIGH=TRUE. This indicator is ON when HIGH=TRUE logic is selected and Switch No. 2 on the Switch Assembly is ON. Should it be necessary, this indicator may be disabled by turning Switch No. 2 on the Switch Assembly to the OFF position. (No separate logic indicator is provided for LOW=TRUE operation.)

SWITCH SELECTION

Figure 2 shows the settings of the TTL Logic Level Switch Assembly on the Module. These rocker switches are to be set by the user prior to installation of the Module in the Chassis.

The TTL Logic Level Switch Assembly is located on the component side of the Module circuit board, near the output terminals. The Module cover must be removed to expose the Switch Assembly. Four screws hold this plastic cover to the Module at its corners.

POWER SUPPLY REQUIREMENTS

CAUTION: Misapplication of AC voltage or application of reverse DC voltage can cause a failure or damage the output circuitry of the Module.

For the TTL **output** circuitry of the Module, a customer-supplied 5V DC power source is connected to the Wiring Arm of the Module. This source must be capable of providing 250 mA to each TTL Output Module. (The use of this separate source is required to provide electrical isolation between Module logic circuitry and the user's TTL devices.)

The **logic** circuitry of the TTL Output Module is powered by the PLC, PLC-2, or Bulletin 1771 Power Supply which connects to the I/O Chassis. The +5V DC current drawn from this Supply by the TTL Output Module depends on the number of outputs that are ON at a specific time. The term "ON" means that the output is considered at a TRUE state for the type of logic selected. (Note that this refers not only to the high or low voltage level at the output, but also to the logic level switch selection made by the user.)

CONNECTIONS

CAUTION: Power must be removed from the Module before it is placed into, or removed from, the I/O Chassis. This means that **both** power from the Power Supply connected to the I/O Chassis and power from the user-supplied 5V DC source must be turned OFF. Failure to observe this caution can result in damage to the module.

Connection of user TTL output devices to the Module's Field Wiring Arm is made using Belden No. 8761 or equivalent cable. Follow the Connection Diagram in this Publication.

This cable has a foil shield with a bare stranded drain wire. These are to be grounded at one end of the cable only. The best ground for this connection is usually the enclosure ground at an I/O Chassis mounting bolt or stud. At the other end of the cable, which connects to the user device, the shield is cut short and taped back to prevent it from making electrical contact.

To ground the shield at the I/O Chassis end, carefully remove a length of cable jacket and pull back the foil shield from the insulated wires. Twist this shield and bare stranded drain wire together to form a single strand. Clip the insulated wires to extend no more than 2 inches beyond the cable jacket and make connection to the appropriate Wiring Arm terminals. Then, fold the shield back and route it to the Chassis ground. (Refer to Figure 3.)

The single ground at the Chassis is the only electrical contact of the shield. Where necessary, use electrical tape to insulate the shield from any other contact.

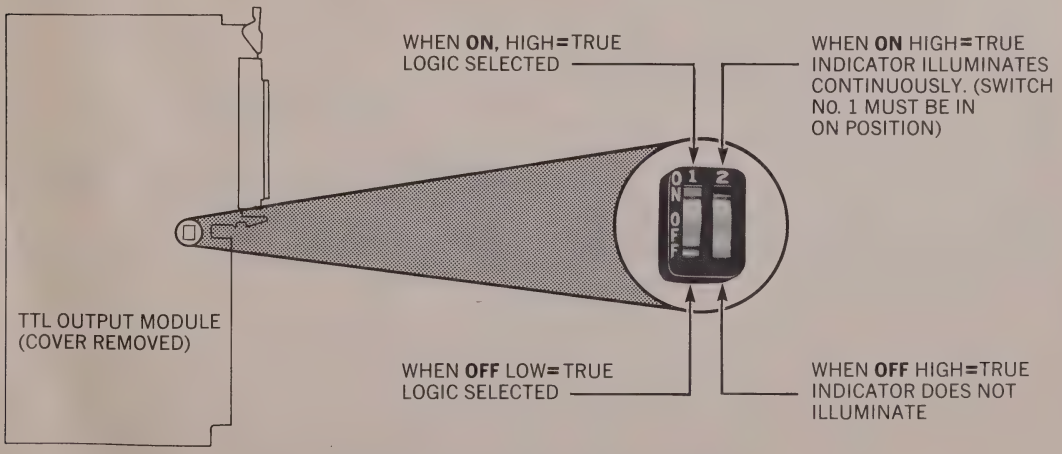
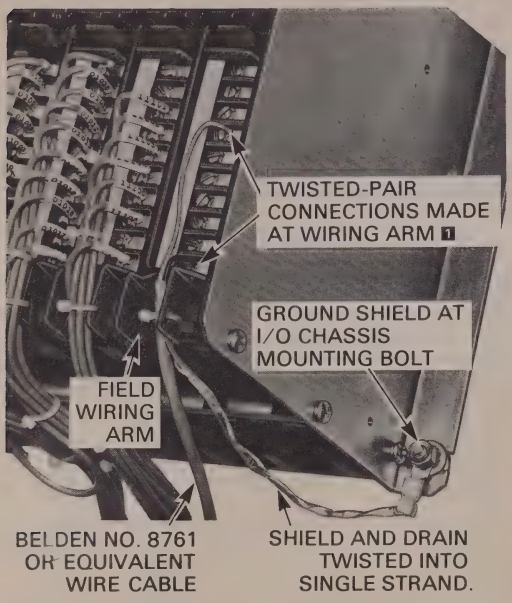


FIGURE 2 - TTL Logic Level Switch Assembly


TWISTED-PAIR CONNECTIONS MADE AT WIRING ARM 1
GROUND SHIELD AT I/O CHASSIS MOUNTING BOLT
FIELD WIRING ARM
BELDEN NO. 8761 OR EQUIVALENT WIRE CABLE
SHIELD AND DRAIN TWISTED INTO SINGLE STRAND.

1 Refer to individual I/O Module Data Sheets for exact twisted-pair terminal connections.

FIGURE 3 - Cable Shield Grounding

The recommended maximum cable length is 50 feet.

The signal ground return wire of each transmission cable must be connected to the user power supply DC common at **both** transmitting and receiving ends. (Do not confuse this connection with the practices for shield grounding, as outlined here. Refer to the Connection Diagram.)

A reverse-biased Schottky diode can be used to limit negative overshoot at the receiving end. A Schmitt trigger input may be used to increase noise immunity when located near user TTL circuitry.

Customer-supplied gates used as receivers should have all inputs tied to the signal line. A single gate should be used as the termination of a signal line. Avoid using other logic inputs to the receiving gate.

Source current is provided on the Module through a pull-up resistor to the +5V DC line.

Output terminals of the TTL Output Module (Cat. No. 1771-OGC) may directly drive terminals of the TTL Input Module (Cat. No. 1771-IGC). Connect the cable shield between modules at one end only.

KEYING

In initial design stages, the TTL Output Module may be inserted into any I/O module slot of the I/O Chassis. However, once specific slots have been designated for a module, care should be taken so that other types of modules will not be mistakenly placed into these slots. Plastic keying bands, shipped with each I/O Chassis, provide an easy method for the user to key an I/O slot to accept only one type of I/O module. Use of these keying bands is strongly recommended.

Each type of I/O module is slotted in two places at its rear edge. The position of the keying bands on the backplane connector must correspond to these slots to allow insertion of the module. Any I/O Rack connector may be keyed solely to receive the TTL Output Module (Cat. No. 1771-OG).

For the TTL Output Module, position keying bands on the upper backplane connector between these numbers printed on the backplane:

- Between 6 and 8
- Between 10 and 12

Refer to Figure 4.

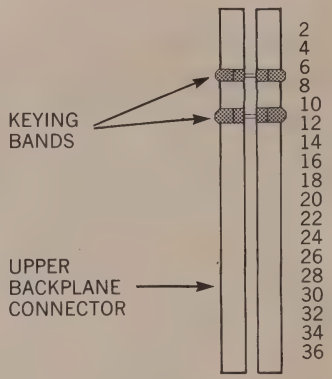
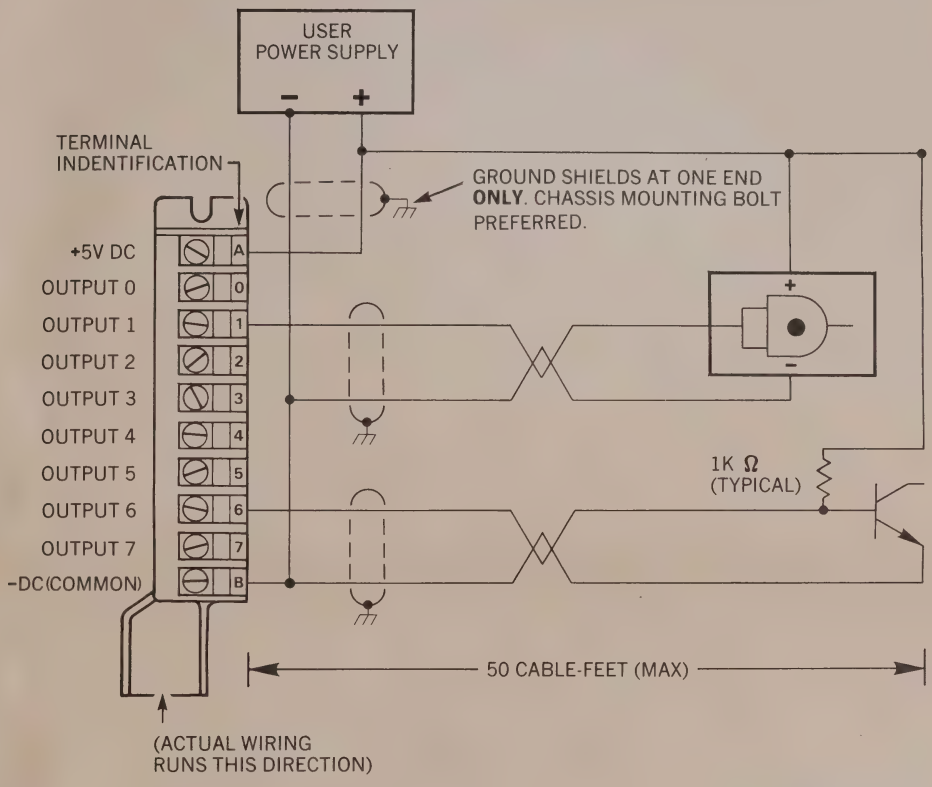


FIGURE 4 - Keying Diagram

The position of these bands may be changed by the user if subsequent system design and rewiring make insertion of a different type of module necessary.

Needle-nose pliers may be used to insert or remove keying bands.

CONNECTION DIAGRAM
(See applicable codes and laws)



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Section 3
OPERATION WITH PLC-2

3.0 Introduction – This Section describes two different methods for operating the Digital Cassette Recorder:

- With PLC-2 controller equipment only
- With a mixture of PLC-2 and PLC controller equipment

Paragraph 3.1 outlines the steps necessary for proper operation of the Recorder when only the Bulletin 1772 PLC-2 Program Panel (Cat. No. 1772-TA) is used. Paragraph 3.2 outlines the steps necessary for proper operation of the Recorder when the Bulletin 1774 Program Panel (Cat. No. 1774-TA) is used in conjunction with the PLC-2 controller. Note that this arrangement requires the use of the PLC/PLC-2 Program Panel Adapter (Cat. No. 1772-T4).

3.1 PLC-2 Equipment Only – This discussion outlines the use of the Digital Cassette Recorder with the PLC-2 Program Panel (Cat. No. 1772-TA). (Refer to Figure 12.) Before actual use certain preliminary procedures should be followed.

Step 1 – Connect the Digital Cassette Recorder power cable to a grounded (3-hole) 120V AC receptacle. (Refer to Figure 13.)

Step 2 – Insert a Cassette Tape (Cat. No. 1770-XA) into the tape drive mechanism. (The magnetic tape should face towards you as the Cassette is inserted. Refer to Figure 6.)

Step 3 – Set the power ON/OFF switch to the ON position. The POWER ON indicator on the Recorder illuminates when power is applied. (Refer to Figure 2.)

Step 4 – Connect either end of the Program Panel Interconnect Cable (Cat. No. 1772-TC) to the socket labeled PROGRAM PANEL at the front of the Processor. Connect the other end to the socket labeled PROCESSOR, located at the rear of the Program Panel (Cat. No. 1772-TA). (Refer to Figure 13 and 14.) The Cable may be oriented either way since the connectors are identical.

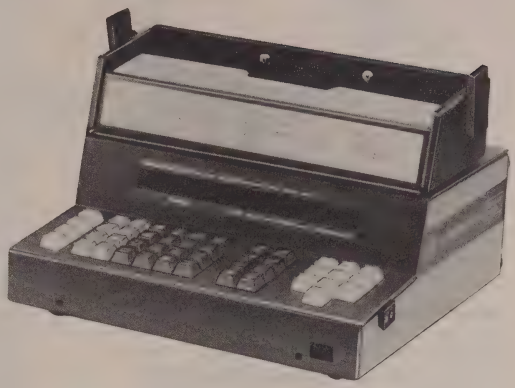


Figure 12 – PLC-2 Program Panel

Note: There is no need to remove power from the System Power Supply while inserting or removing the Program Panel Interconnect Cable.

Step 5 – Insert the grey connector of the Digital Cassette Recorder Cable labeled Cat. No. 1772-TH into the socket labeled PERIPHERAL at the rear of the Program Panel. Insert the black connector labeled CASSETTE into the socket labeled OTHER A-B PRODUCTS on the Digital Cassette Recorder. For the most trouble-free operation this connection should be secured by tightening two mounting screws in this connector.

3.1.1 Recording Programs – When recording the program stored in the PLC-2 memory, the Mode Select Switch on the Processor may be in any position. Proceed as follows:

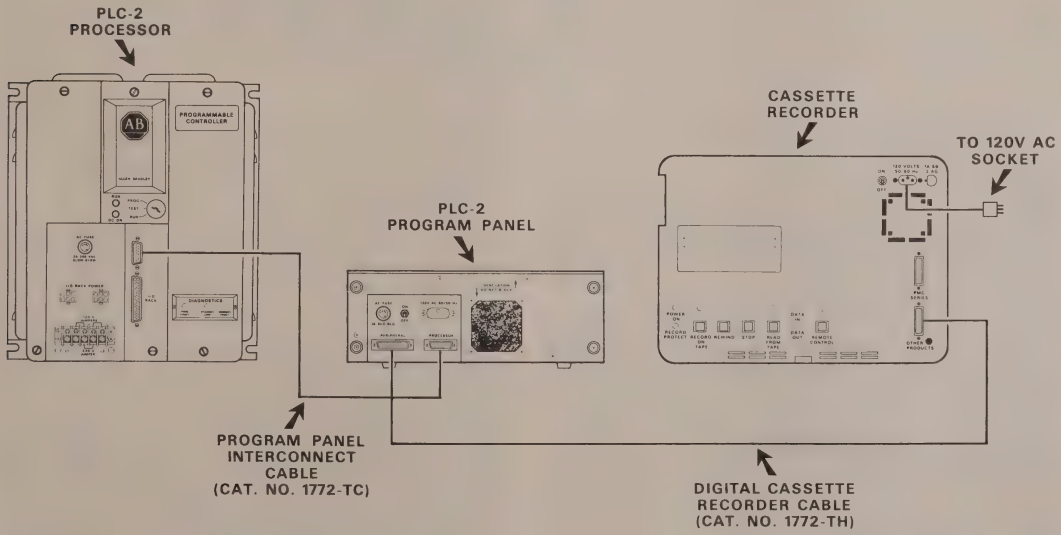


Figure 13 – PLC-2, Recorder Connection Diagram

Figure 14 — Digital Cassette Recorder Cable

Step 1 — Press the REWIND push button to make sure that the Cassette Tape is completely rewound. (The recording **must** start at the beginning of the tape.)

Step 2 — Press [CANCEL COMMAND] [SEARCH] [RUNG ↑] to display the first program instruction.

Step 3 — Press [RECORD] [0] on the Program Panel keyboard. The message EXC 0 then illuminates on the Program Panel display.

Step 4 — When the tape is completely rewound, press the RECORD ON TAPE push button on the Recorder. The Recorder's operation at this point depends on the position of the Recording Tab on the Cassette Tape.

If the Recording Tab is set to the YES WRITE position, the Recorder will operate, and the indicator above the RECORD ON TAPE push button illuminates. Then, later, the DATA IN indicator illuminates, thereby showing that a program is being recorded on tape.

If the Recording Tab is set to the NO WRITE position, the RECORD PROTECT indicator illuminates, but the drive mechanism does not operate. The RECORD ON TAPE indicator does **not** illuminate, and data is not written onto the tape. The data on the tape is protected.

Step 5 — When the DATA IN indicator goes OFF and the tape has stopped, the program has been recorded onto tape. The message EXC 1 then illuminates on the Program Panel display.

In order to cancel the RECORD ON TAPE mode, press the REWIND push button. The RECORD ON TAPE indicator then goes OFF. (The REWIND push button has no effect if the tape is still in motion.)

Step 6 — After a program has been recorded, press the READ FROM TAPE push button. This begins the verification process. It is the user's responsibility to verify that the data recorded on the tape **exactly matches** the data in the PLC-2 controller's memory. Follow the verification procedure in Paragraph 3.1.3.

CAUTION: Always verify programs stored on Cassette Tape. Subsequent improper operation results if data stored on tape does not match the data stored in memory.

Step 7 — The user may protect the program just recorded on the Cassette Tape by moving the Recording Tab on the Cassette Tape to the NO WRITE position. (Refer to Figure 4 and Paragraph 1.2.)

3.1.2 Loading Programs — To load a taped program into the PLC-2 memory, proceed as follows:

Step 1 — Determine that the total memory capacity of the specific PLC-2 Processor is large enough to accept the program stored on the Cassette Tape.

CAUTION: Never load a user program into the PLC-2 Processor's memory if the program on tape exceeds memory capacity. Failure to follow this caution results in improper operation.

In order to determine the memory capacity of an individual PLC-2 Processor, remove the metal plate on the right side of the Processor front panel. (Loosen two thumb screws, one at the top, one at the bottom.) Two modules are visible. The Memory Module is at the right. Visually inspect this Module. Count the number of Memory Segments (Cat. No. 1772-MR). (Refer to Figure 15.) Each Memory Segment has storage capacity for 512 words. Refer to Table E where capacities are listed.

Table E
PLC-2 MEMORY SEGMENT-WORD RELATIONS

MEMORY SEGMENTS (Cat. No. 1772-MR)	CAPACITY (in words)
1	512
2	1024
3	1536
4	2048

Step 2 — Set the Mode Select Switch on the Processor to the PROG position.

Step 3 — Press the REWIND push button on the Recorder to be sure the Cassette Tape is completely rewound.

Step 4 — Press [CANCEL COMMAND] [SEARCH] [RUNG ↑] to display the first program instruction.

Step 5 — Press [RECORD] [0] on the PLC-2 Program Panel keyboard. The message EXC 0 appears on the Program Panel display.

Step 6 — Press the READ FROM TAPE push button on the Recorder. The READ FROM TAPE indicator illuminates. After a brief interval, the tape transport mechanism begins operating. The DATA OUT indicator illuminates, indicating that the data from the tape is being loaded into the memory of the PLC-2 Processor. Previous data, stored beyond the new END (of program) instruction, is cleared.

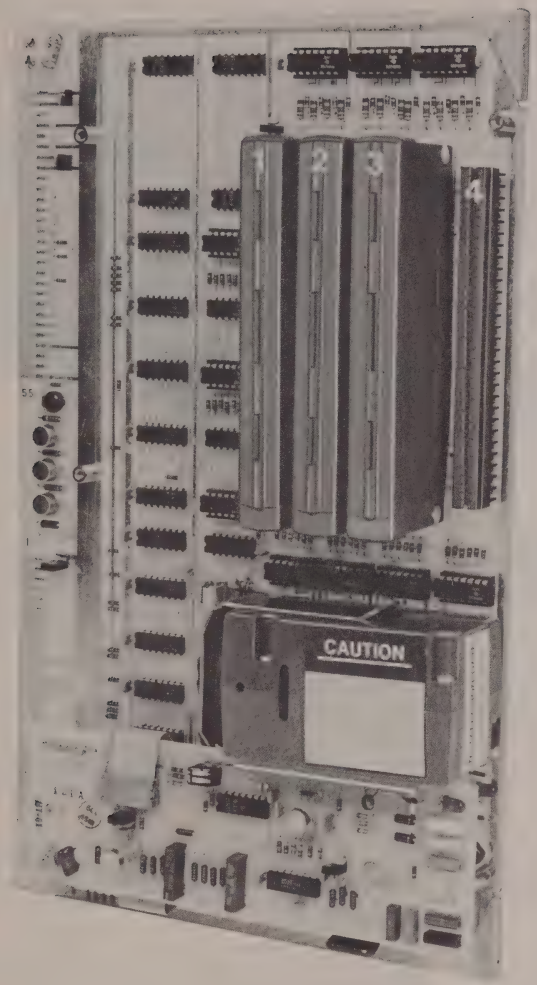
Step 7 — When the DATA OUT indicator goes OFF and the Tape has stopped, the program has been loaded into the PLC-2 memory. The message EXC 1 appears on the Program Panel display. In order to cancel the READ FROM TAPE mode, press REWIND push button. The READ FROM TAPE indicator then goes OFF.

Step 8 — After a program has been loaded into a PLC-2 memory, press the READ FROM TAPE push button. This begins the verification which is necessary to establish that the loading was accurate. Follow the verify procedure in Paragraph 3.1.3.

CAUTION: Always verify all programs loaded into the PLC-2 memory. Subsequent unintended operation may result if the two programs are not identical.

Step 9 — If, during an attempt to load or verify a program, the message EXC 50 XX (where XX represents a decimal number from 00 thru 40) appears on the Program Panel display, the Parameter Table value in memory does **not** match the Parameter Table value on tape.

The 2-digit number following EXC 50 is the Parameter Table value **on the cassette tape**. When the Parameter Table values do not match, the program cannot be loaded or verified from tape into memory. The value in memory must be changed to the value on tape. To do so, enter



MEMORY SEGMENTS:

1 - 512
2 - 1024
3 - 1536
4 - 2048

Figure 15 – PLC-2 Memory Segments

[CANCEL COMMAND] [SEARCH] [5] [0] followed by the 2-digit number displayed at the right of EXC 50. Rewind the tape and resume the load operation.

3.1.3 Verifying Programs – After a program has been loaded into a PLC-2 memory from tape, or after the contents of memory have been recorded onto tape, it is important to verify that the data transfer was accurate.

Verification of the user program must start at the first program instruction or the START message. The Data Table is compared only on the first verification after a load or record operation, and only when the Mode Select Switch is left in the PROG position. If it is not necessary to compare the data contained in the Data Table, the Mode Select Switch can be in any position during verification. Proceed as follows:

Step 1 – Press the REWIND push button on the Recorder to assure that the Cassette Tape is **completely** rewound.

Step 2 – Press [CANCEL COMMAND] [SEARCH] [RUNG ↑] to display the first program instruction or the START message.

Step 3 – Press [RECORD] [1] on the Program Panel keyboard. The message EXC 1 appears on the Program Panel display.

Step 4 – Press the READ FROM TAPE push button on the Recorder. The READ FROM TAPE indicator illuminates. After a brief delay, the tape transport mechanism begins operating. Then the DATA OUT indicator illuminates, showing that data from the tape is being transmitted to the Processor.

Step 5 – When the DATA OUT indicator goes OFF, and tape transport motion stops, verification is complete, or the process is terminated early because the maximum number of errors is reached.

Users must examine the FORCED indicator on the PLC-2 Program Panel. If it is not illuminated, no errors were discovered. If it is illuminated, at least one error was discovered.

CAUTION: Always examine the FORCED indicator before pressing any push buttons on the Recorder. The indicator stops illuminating when the mode of the Recorder is changed. Thus a new verification would be required to establish whether or not there were errors.

In order to cancel the READ FROM TAPE mode, press either the STOP or REWIND push button. The READ FROM TAPE indicator then goes OFF. (Pushing the REWIND push button has no effect if the tape is in motion.).

Step 6 – If a miscomparison is detected, it is considered an "error." The FORCED indicator on the Program Panel display illuminates. (Refer to Figure 16.) The user may terminate the verification, or continue on with it. The PLC-2 Processor will continue the verification process until a maximum of 18 errors is detected. At that time the process stops regardless of the point in the program.

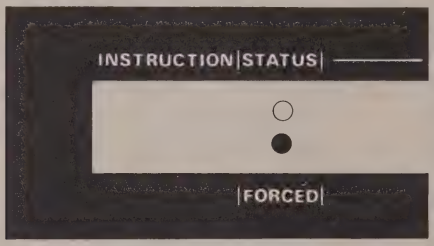


Figure 16 – Error Indication on FORCED Display

Assuming the verification was allowed to continue even though errors are detected, the DATA OUT and READ FROM TAPE indicators on the Recorder will go OFF after the entire program has been compared. However, the FORCED indicator on the Program Panel remains illuminated, and the user should use it to determine whether or not the verification was error-free.

When an error is detected, the user has two alternatives:

- In the case of a record from tape operation, the entire program could be loaded again and, subsequently, verified. In the case of a record on tape operation the entire program could be recorded again on the Cassette Tape and then verified.
- In the case of a record from tape operation, an attempt can be made to locate and correct errors to the user program stored in memory. This involves the use of the Program Panel.

Note that the verification process of the entire memory stops once the 18-error limit is reached.

If errors occur during a record on tape operation, the program in the PLC-2 memory must be assumed to be valid, and the error must be in the program stored on tape. Thus, the only practical procedure is to initiate a new record on tape operation.

Note that the verification process does **not** indicate exactly which storage medium contains the error. The user must determine which medium is the "source" and which is the "copy." Then he must decide if the medium allows correction (as the PLC-2 memory does) or does not allow correction (as the Cassette Tape does not).

3.1.4 Searching, Correcting Errors – Errors detected in the user program during the verification process may be quickly and conveniently located and displayed with the Program Panel. Errors are indicated with one of the following messages:

- NON – This message indicates the verification of the memory and the tape was error free.
- ERR 99 – This message indicates an error in the Data Table was detected.
- ERR 01 thru 18 – This message shows the number of errors found in the user program. The 2 digits indicate the number of errors.

Note: Do not confuse these error messages having two digits with the system error messages which have only one digit. Their meanings are not related. Thus the display ERR1 does **not** equal ERR 01.

Although the NON message does not call for further operator action, the ERR messages do.

ERR 99 indicates that the Data Table has been miscompared. Another record or load and subsequent verification must be performed.

ERR 01 thru 18 indicate that, if the user chooses, the errors could be located and corrected. (This assumes that a hardcopy of the program stored on Cassette Tape is available.) This may be done only if a memory is being loaded into memory from tape.

ERR 18 also indicates that there may be an excessive number of errors. If data was loaded from tape into memory, corrective action would be to correct one error in memory, then perform another verification. If the number of errors displayed is now reduced to 17, the user may continue error correction. If the number of errors displayed remains 18, an excessive number of errors may exist. This could be the result of improper connections. (Refer to Section 5 for additional corrective measures.) This may also be the result of a missing program step which throws the entire comparison out of synchronization.

To locate errors in the program follow this procedure:

Step 1 – If an error message is displayed, continue on with Step 3.

Step 2 – If an error message is not displayed, press [CANCEL COMMAND] [SEARCH] [9] on the Program Panel keyboard. An error message then appears on the Program Panel display.

Step 3 – Press [SEARCH] [0] [1]. The first instruction detected to be in error then appears on the Program Panel display. Errors can be corrected, using editing procedures, by referring to a hardcopy (ladder diagram printout) of the correct program.

Step 4 – Press [SEARCH] [0] [2]. The second error is displayed. Continue in this manner until all errors, up to a maximum of 18, have been corrected.

Step 5 – If the user chooses to edit errors, he must then initiate another verification. This assures program accuracy.

CAUTION: Even after correcting 18 errors, the user must verify the program again. Additional errors may be discovered. Improper operation results if program errors still exist in the program stored in the PLC-2 memory.

3.2 PLC and PLC-2 Equipment – This discussion outlines the use of the Digital Cassette Recorder when used with a Bulletin 1772 PLC-2 Processor and a Bulletin 1774 PLC Program Panel. This arrangement requires a PLC/PLC-2 Program Panel Adapter. (Refer to Figure 17.)

Before actual use, certain preliminary procedures should be followed.

Step 1 – Connect the Digital Cassette Recorder power cable to a grounded (3-hole) 120V AC receptacle. (Refer to Figure 18.)

Step 2 – Insert a Cassette Tape (Cat. No. 1770-XA) into the tape drive mechanism. (The magnetic tape should face towards you as the Cassette is inserted. Refer to Figure 6.)

Figure 17 – PLC Program Panel and PLC-2 Adapter

Step 3 – Set the ON/OFF switch on the Recorder to the ON position. The POWER ON indicator on the Recorder illuminates when power is applied. (Refer to Figure 2.)

Step 4 – Connect either end of the Program Panel Interconnect Cable (Cat. No. 1772-TC) to the socket labeled PROGRAM PANEL at the front of the Processor. Connect the other end to the socket labeled PROCESSOR, located at the rear of the PLC/PLC-2 Program Panel Adapter (Cat. No. 1772-T4). (Refer to Figure 18.)

Note: There is no need to remove power from the System Power Supply when inserting or removing the Program Panel Interconnect Cable.

Step 5 – Insert the grey connector of the Digital Cassette Recorder Cable labeled Cat. No. 1772-TH into the socket labeled PERIPHERAL at the rear of the PLC/PLC-2 Program Panel Adapter. Insert the black connector labeled CASSETTE into the socket labeled OTHER A-B PRODUCTS on the Digital Cassette Recorder. For the most trouble-free operation, this connection should be secured by tightening two mounting screws on this connector.

Step 6 – Connect one end of the PLC/PLC-2 Program Panel Adapter Cable (Cat. No. 1772-TR) to the socket labeled PLC PROGRAM PANEL at the rear of the PLC/PLC-2 Program Panel Adapter. Connect the other end of this cable to the socket labeled PROCESSOR at the rear of the Bulletin 1774 Program Panel.

3.2.1 Recording Programs – When recording the program stored in the PLC-2 memory, the Mode Select Switch on the Processor may be in any position. Proceed as follows:

Step 1 – Press the REWIND push button to make sure that the Cassette Tape is completely rewound. (The recording **must** start at the beginning of the tape.)

Step 2 – Press [CANCEL COMMAND] [SEARCH] [RUNG ↑] to display the first program instruction.

Step 3 – Press [RECORD] [0] on the Bulletin 1774 Program Panel keyboard. The message RECORD 0 – RECORD PROGRAM ON MAG. TAPE OR LOAD MEMORY FROM TAPE appears on the PLC Program Panel display screen.

Step 4 – When the tape is completely rewound, press the RECORD ON TAPE push button on the Recorder. The message RECORD 0 – RECORD PROGRAM ON MAG. TAPE appears on the display screen after approximately 4 seconds. The Recorder's operation at this point depends on the position of the Recording Tab on the Cassette Tape.

If the Recording Tab is set to the YES WRITE position, the Recorder will operate, and the indicator above the RECORD ON TAPE push button illuminates. Then, later,

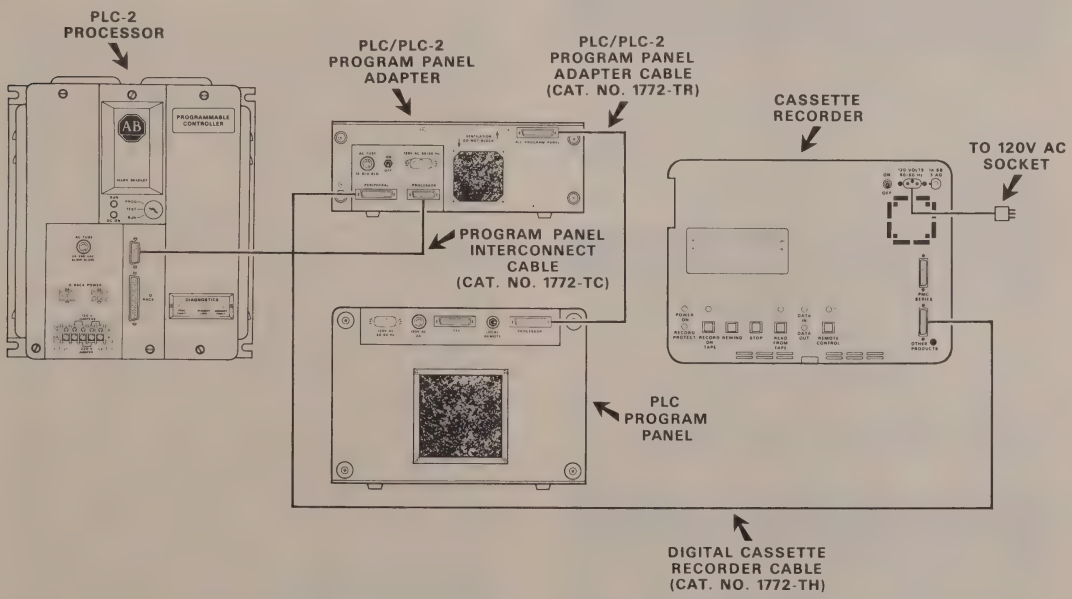


Figure 18 – Connection Diagram for Mixed PLC and PLC-2 Units

the DATA IN indicator illuminates, thereby showing that the program is being recorded on tape.

If the Recording Tab is set to the NO WRITE position, the RECORD PROTECT indicator illuminates, but the drive mechanism does not operate, the RECORD ON TAPE does not illuminate, and data is not written onto the tape. The data on tape is protected.

Step 5 – When the DATA IN indicator goes OFF, and the tape has stopped, the program has been recorded onto tape. The message RECORD 1 – VERIFY MAGNETIC TAPE appears on the Bulletin 1774 Program Panel display screen.

In order to cancel the RECORD ON TAPE mode, press either the STOP or REWIND push button. The RECORD ON TAPE indicator then goes OFF.

Step 6 – After a program has been recorded, press the READ FROM TAPE push button. This begins the verification process. It is the user's responsibility to verify that the data recorded on tape **exactly matches** the data in the PLC-2 controller's memory. Follow the verification procedure in Paragraph 3.2.3.

CAUTION: Always verify programs stored on the Cassette Tape. Subsequent improper operation results if data stored on tape does not match the data stored in memory.

Step 7 – The user may protect the program just recorded on the Cassette Tape by moving the Recording Tab on the Cassette Tape to the NO WRITE position. (Refer to Figure 4 and Paragraph 1.2.)

3.2.2 Loading Programs – To load a taped program into the PLC-2 controller's memory, proceed as follows:

Step 1 – Determine that the total memory capacity of the specific PLC-2 Processor is large enough to accept the program stored on the Cassette Tape.

CAUTION: Never load a user program into the PLC-2 Processor's memory if the program on tape exceeds memory capacity. Failure to follow this caution results in improper operation.

In order to determine the memory capacity of an individual PLC-2 Processor, remove the metal panel on the right side of the Processor. (Loosen two thumb screws, one at the top, one at the bottom.) Two modules are visible. The Memory Module is at the right. Visually inspect this Module and count the number of Memory Segments (Cat. No. 1772-MR). (Refer to Figure 15.) Each Memory Segment has storage capacity for 512 words. Refer to Table E where capacities are listed.

Step 2 – Set the Mode Select Switch on the Processor to the PROG position.

Step 3 – Press the REWIND push button on the Recorder to be sure the Cassette Tape is completely rewound.

Step 4 – Press [CANCEL COMMAND] [SEARCH] [RUNG ↑] on the Bulletin 1774 Program Panel keyboard. The first program instruction appears.

Step 5 – Press [RECORD] [0] on the Bulletin 1774 Program Panel keyboard. The message RECORD 0 – RECORD PROGRAM ON MAG. TAPE OR LOAD MEMORY FROM TAPE appears on PLC Program Panel display screen.

Step 6 – Press the READ FROM TAPE push button on the Recorder. The READ FROM TAPE indicator illuminates. The message RECORD 0 – LOAD MEMORY FROM TAPE appears on the display screen after approximately 4 seconds. The tape transport begins to move. After a few seconds, the DATA OUT indicator illuminates, indicating that the data from the tape is being loaded into the memory of the PLC-2 Processor. (Previous data, stored beyond the END (of program) instruction, is cleared.)

Step 7 – When the DATA OUT indicator goes OFF, and the Tape has stopped, the program has been loaded into the PLC-2 memory. The message DONE appears on the Bulletin 1774 Program Panel display screen. In order to cancel the READ FROM TAPE mode, press the REWIND push button. The message RECORD 1 – VERIFY MAGNETIC TAPE now appears on the display screen. The READ FROM TAPE indicator then goes OFF.

Step 8 – After the program has been loaded into a PLC-2 memory, press the READ FROM TAPE push button. The verification process begins. It is the user's responsibility to verify that the loading was accurate by following the procedure in Paragraph 3.2.3.

CAUTION: Always verify all programs loaded into the PLC-2 memory. Subsequent improper operation results if the program on tape does not match the program stored in memory.

Step 9 – If, during an attempt to load a program into memory, the message NO. OF T/C = XX (where XX represents a decimal number from 00 thru 40) appears on the Bulletin 1774 Program Panel display screen, the Parameter Table value in memory does not match the Parameter Table value on tape.

The 2-digit number following the equal sign is the Parameter Table value **on the tape**. The values must match exactly for the program on tape to be loaded into memory. If the values do not match, the Parameter Table value in memory must be changed to that recorded on tape. To do so, enter [CANCEL COMMAND] [SEARCH] [5] [0] followed by the 2-digit number that appears at the right of NO. OF T/C = that is displayed on the Bulletin 1774 Program Panel. Rewind the tape and resume the load operation.

3.2.3 Verifying Programs – After a program has been loaded into PLC-2 memory from tape, or after the contents of memory have been recorded onto tape, it is important to verify that the data transfer was accurate.

Verification of the user program must start at the first instruction in the user program or at the START message. The Data Table is compared only on the first verification after a load or record operation, and only when the Mode Select Switch is left in the PROG position. If it is not necessary to compare the data contained in the Data Table, the Mode Select Switch can be in any position during verification. Proceed as follows:

Step 1 – Press the REWIND push button on the Recorder to be sure that the Cassette Tape is **completely** rewound. If verification is performed immediately after a load or record operation, RECORD 1 – VERIFY MAGNETIC TAPE appears on the display screen. Proceed with Step 4.

Step 2 – Press [CANCEL COMMAND] [SEARCH] [RUNG ↑] to display the first program instruction.

Step 3 – Press [RECORD] [1] on the Bulletin 1774 Program Panel keyboard. The message RECORD 1 – VERIFY MAGNETIC TAPE appears on the Program Panel display screen.

Step 4 – Press the READ FROM TAPE push button on the Recorder. The READ FROM TAPE indicator illuminates. After a short delay, the tape transport mechanism starts operating. Then the DATA OUT indicator illuminates after approximately 15 seconds showing that data from the tape is being transmitted to the Processor.

If RECORD ON TAPE is pressed, the display will change to RECORD 0 – RECORD PROGRAM ON MAG. TAPE after a delay of approximately 15 seconds, and the contents of the memory will be recorded on tape.

Step 5 – When the DATA OUT indicator goes OFF, and

the tape transport motion stops, verification is complete or the process is terminated early because the maximum number of errors is reached. Examine the message on the Program Panel.

CAUTION: Always examine the Program Panel displayed message before pressing any push buttons on the Recorder. The message disappears from the screen whenever the Recorder mode is changed.

In order to cancel the READ FROM TAPE mode, press the REWIND push button. The READ FROM TAPE indicator then goes OFF.

Step 6 – Examine the Program Panel display screen. If the message 00 ERRORS WERE FOUND is displayed, the verification is accurate, and no errors were found.

Step 7 – If a miscomparison is detected in the Data Table, it is considered an "error." The message DATA TABLE ERROR FOUND is displayed on the Bulletin 1774 Program Panel display screen. If a miscomparison is detected in the user program, the message XX ERRORS WERE FOUND is displayed on the Bulletin 1774 Program Panel. (XX may be any 2-digit number from 01 thru 18.) Another record or load, together with a subsequent verification, must be performed.

Assuming the verification of the Data Table was error free, verification of the user program begins. The DATA OUT and READ FROM TAPE indicators on the Recorder go OFF after the entire program has been compared.

When an error is detected, the user has two alternatives:

- In the case of a record from tape operation, the entire program could be loaded again and, subsequently, verified. In the case of a record on tape operation, the entire program could be recorded again on the Cassette Tape and then verified.
- In the case of a record from tape operation, an attempt can be made to locate and correct errors to the user program stored in memory. This involves the use of the Bulletin 1774 Program Panel and the PLC/PLC-2 Program Panel Adapter.

The PLC-2 Processor will continue the verification process until a maximum of 18 errors is found. At that time the process stops, regardless of the point in the Data Table or program, and the Bulletin 1774 Program Panel displays the message 18 ERRORS FOUND.

3.2.4 Searching, Correcting Errors – Errors detected in the user program during the verification process may be quickly and conveniently located and displayed with the Bulletin 1774 Program Panel. Errors are indicated with one of the following messages:

- 00 ERRORS WERE FOUND – This message indicates the verification of the memory and tape was error free.
- DATA TABLE ERROR FOUND – This message indicates an error in the Data Table was detected.
- 01 thru 18 ERRORS WERE FOUND – This message shows the number of errors found in the user program.

The message 00 ERRORS WERE FOUND indicates that further action is not needed. The other two messages call for further action.

Messages 01 thru 18 ERRORS WERE FOUND indicate that, if the user chooses, the errors could be located in the program stored in PLC-2 memory and corrected. This assumes that a hardcopy of the program stored on Cassette Tape is available.

The message 18 ERRORS WERE FOUND also indicates that an excessive number of errors may exist. If the data was recorded from tape into memory, action could be taken to correct one error in memory, then verify the program again. If the number of errors displayed is now reduced to 17, the user may continue error correction. If, however, the number of errors displayed is still 18, an excessive number of errors exists, and it may become difficult to edit such a large number. This could be the result of improper connections. It could also result from a missing program step which throws the entire comparison out of synchronization.

If data transfer was from memory to tape, another recording, and subsequent verification, should be performed.

To locate errors in the user program follow these steps.

Step 1 – If an error message is displayed, continue on with Step 3.

Step 2 – If an error message is not displayed, press [CANCEL COMMAND] [SEARCH] [9] on the Program Panel keyboard. An error message then appears on the Program Panel display screen.

Step 3 – Press [SEARCH] [0] [1]. The first instruction detected to be in error then appears on the Program Panel display screen. Errors can be corrected, using editing procedures, by referring to a hardcopy of the correct program.

Step 4 – Press [SEARCH] [0] [2]. The second error is displayed. Continue in this manner until all errors, up to a maximum of 18, have been corrected.

Step 5 – If the user chooses to edit errors, he must then initiate another verification. This assures program accuracy.

CAUTION: Even after correcting 18 errors, the user must verify the program again. Improper operation results if program errors still exist in the program stored in the PLC-2 memory.

3.3 Summary – Included here is a quick reference summary list of commands to be used when operating the Digital Cassette Recorder with a PLC-2 controller.

RECORDING/VERIFYING PROGRAMS (any mode)

1 – On the Recorder press REWIND.

2 – On the Program Panel enter [RECORD] [0].

3 – On the Recorder press RECORD ON TAPE.

4 – On the Recorder press REWIND.

5 – On the Recorder press READ FROM TAPE.

LOADING/VERIFYING PROGRAMS (PROG mode only)

1 – Set the Mode Select Switch to PROG.

2 – On the Recorder press REWIND.

3 – On the Program Panel enter [RECORD] [0].

4 – On the Recorder press READ FROM TAPE.

5 – On the Recorder press REWIND.

6 – On the Recorder press READ FROM TAPE.

VERIFYING PROGRAMS (any mode)

1 – On the Recorder press REWIND.

2 – On the Program Panel enter [RECORD] [1].

3 – On the Recorder press READ FROM TAPE.

NOTES

Section 4
PMC OR MINI-PMC OPERATION

4.0 Preliminary Steps — Before operating the Digital Cassette Recorder with either a Bulletin 1750 PMC or Bulletin 1755 Mini-PMC programmable controller, make the following preliminary steps.

Step 1 — Remove all power from the PMC or Mini-PMC system, and to the Program Panel (Cat. No. 1750-GA). To be de-energized, the Program Panel must be unplugged from its AC power source.

Step 2 — Connect the Program Panel to the PMC or Mini-PMC Processor Rack by using the appropriate Slot Card (module), attached to the Interface Cable. (Refer to Figure 19.) The Slot Card labeled FOR USE WITH 1750-B is used with the pROM Processor Rack (Cat. No. 1750-B). The Slot Card labeled FOR USE WITH 1750-W is used with the R/W Processor Rack (Cat. No. 1750-W). The hold-down screws at both ends of the Cable must be tightened into the receptacles provided. The Slot Card must be inserted, with the component side of the module to your right, into either the:

- INTERFACE slot of the pROM Processor
- PROGRAM PANEL slot in the R/W Processor

Step 3 — Connect the Front Panel Cable between the Program Panel and its lid, which contains the electronics hardware for communications with the Digital Cassette Recorder. (Refer to Figure 19.)

Step 4 — Connect either end of the Recorder Cable (Cat. No. 1750-TD) to the connector labeled TO RECORD DEVICE on the lid of the Program Panel. (Refer to Figure 19 and 20.) Connect the other end of the Cable to the connector labeled PMC SERIES on the Recorder. (Refer to Figure 19.) The slot screws on the connector should be securely fastened into the Recorder.

Step 5 — Connect the power cable between the Recorder and a grounded 3-hole 120V AC receptacle.

Step 6 — Insert a Tape Cassette (Cat. No. 1770-XA) into the transport well. (The magnetic tape should face towards you as you insert. Refer to Figure 6.)

Step 7 — Set the Recorder ON/OFF switch to the ON position. The POWER indicator illuminates when power is on. (Refer to Figure 2.)

Step 8 — Place the Program Panel PANEL MODE keylock switch in the OFF position. (Refer to Figure 20.)

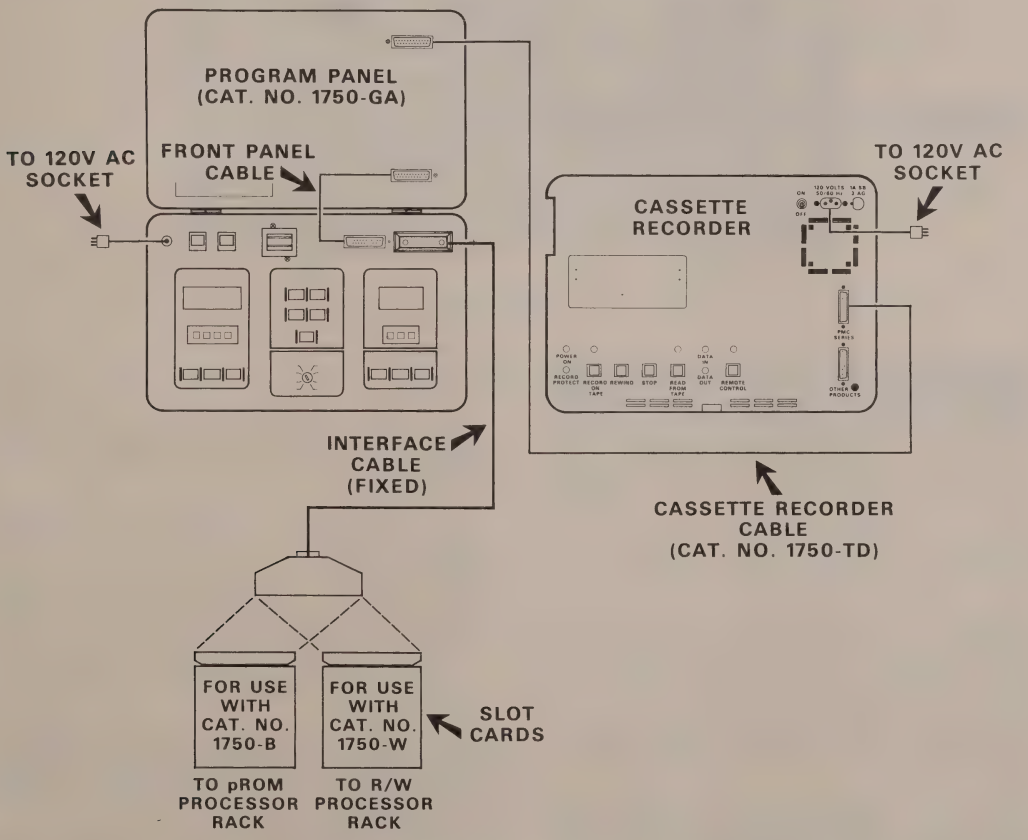


Figure 19 — PMC, Recorder Connection Diagram

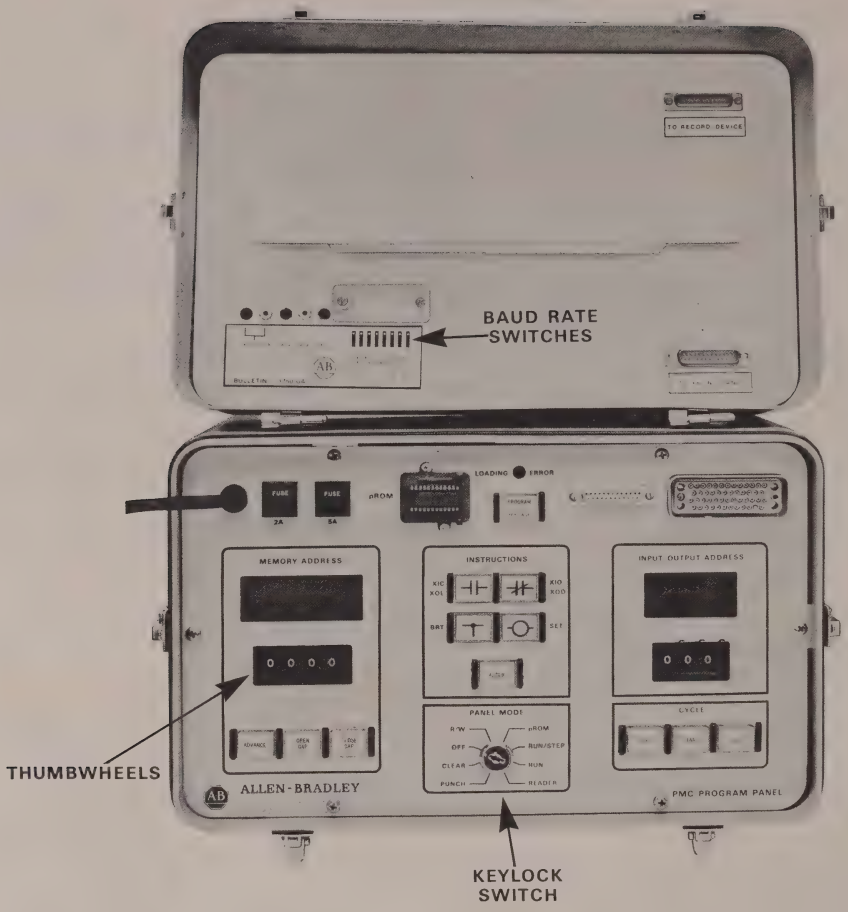


Figure 20 — PMC Loader

Step 9 — Set the Baud Rate switches, which are under the hinged cover in the Program Panel lid, to provide a baud (bits per second) rate of 1200. This establishes the proper communications transmission rate with the 1200-baud Recorder.

Step 10 — Connect the power cable between the Program Panel and a grounded (3-hole) 120V AC receptacle. This energizes the Program Panel.

Step 11 — Apply power to the PMC or Mini-PMC system.

CAUTION: Never remove or insert any module in any PMC or Mini-PMC controller unless the system is completely de-energized. The system can be damaged, and unexpected machine motion can occur.

4.1 Recording Programs — When recording a program from either a R/W or pROM PMC memory, proceed as follows:

Step 1 — On the Program Panel place the PANEL MODE keylock switch in the R/W position. (Refer to Figure 20.) Quickly select the last program instruction with the MEMORY ADDRESS thumbwheel switches. The last instruction should be XIO 77.

Step 2 — Return the MEMORY ADDRESS thumbwheels to 0000, and set the PANEL MODE keylock switch to PUNCH.

Step 3 — On the Cassette Recorder, press the REWIND switch. Watch the tape. If it runs, wait until it stops. This assures complete rewind. (The recording **must** start at the beginning of tape.)

Step 4 — Press the RECORD ON TAPE push button. If the Recording Tab on the Cassette Tape is set to the NO WRITE position, the RECORD PROTECT indicator illuminates, and recording is inhibited. If the Recording Tab is in the YES WRITE position, the tape will run for 8 seconds, then stop. The RECORD ON TAPE indicator remains illuminated.

Step 5 — After the tape stops, press the RECORD ON TAPE switch **again**, and **immediately** press the START switch on the Program Panel. The tape runs, and the Cassette Recorder DATA IN indicator illuminates, indicating that the program is being recorded.

Step 6 — When the DATA IN indicator goes OFF and the tape has stopped, the program has been recorded.

In order to cancel the RECORD ON TAPE mode, press the REWIND push button. The RECORD ON TAPE indicator goes off.

Step 7 – If the program was recorded from a R/W Processor, it must be verified as outlined in Paragraph 4.3. Recordings from pROM Processors cannot be verified.

CAUTION: Always verify any R/W Processor program recorded on a Cassette Tape. Subsequent improper operation may result if the two programs are not identical.

Step 8 – The user may protect the program stored on the Cassette Tape by moving the Recording Tab on the Cassette Tape to the NO WRITE position. (Refer to Figure 4 and Paragraph 1.2.)

4.2 Loading Programs – To load a previously recorded program into a PMC or Mini-PMC R/W Processor memory, proceed as follows:

Step 1 – Set the Program Panel MEMORY ADDRESS thumbwheel switches to 0000.

Step 2 – Set the PANEL MODE keylock switch to CLEAR. While holding down the ALTER switch, press the START switch. This clears the memory.

Step 3 – On the Recorder, press the REWIND switch. Watch the tape. If it runs, wait until it stops. This assures complete rewind. (The loading **must** start from the beginning of tape.)

Step 4 – Set the Program Panel PANEL MODE switch to READER, and press the START switch. The START switch illuminates.

Step 5 – Press the Recorder READ FROM TAPE switch. The READ FROM TAPE indicator illuminates. After a short delay, the tape transport begins running. After a brief interval, the DATA OUT indicator illuminates, indicating that data from the Cassette Tape is going into the R/W Processor memory.

Step 6 – The program has been completely loaded into the R/W Processor memory when the Program Panel STOP indicator illuminates. However, the tape continues to run. To stop the tape, press the Recorder STOP switch. Immediately rewind the tape, as in Step 3.

Step 7 – To verify that the program has been correctly loaded, follow the procedure outlined in Paragraph 4.3.

CAUTION: Always verify any R/W Processor program loaded from Cassette Tape. Subsequent improper operation may result if the two programs are not identical.

4.3 Verifying Programs – After a R/W Processor Program has been recorded on a Cassette Tape, or has been loaded into memory from the tape, verify that the recording and the memory are identical by using the following procedure:

Step 1 – On the Cassette Recorder, press the REWIND switch. Watch the tape and, if it runs, wait until it stops. This assures complete rewind. (The verification must start from the beginning of tape.)

Step 2 – Set the Program Panel MEMORY ADDRESS thumbwheel switches to 0000.

Step 3 – Set the PANEL MODE keylock switch to READER.

CAUTION: In case the Program Panel is already in the READER mode, it is **necessary** to momentarily set the PANEL MODE keylock switch to another mode, and return it to the READER mode. Failure to do this prevents verification.

Step 4 – While holding down the ALTER switch press the START switch. The START switch illuminates.

Step 5 – Press the Recorder READ FROM TAPE switch. The READ FROM TAPE indicator illuminates. After a short delay, the tape transport begins running. After a brief interval, the DATA OUT indicator illuminates, indicating that data from the Cassette Tape is going into the Program Panel for comparison with the R/W Processor Memory.

Step 6 – If an error is found, the Program Panel LOADING ERROR indicator illuminates. In that case, record or load the program again, depending on which operation was being performed, and repeat the verification. (If the error occurs **again**, refer to Paragraph 1.5.) If no error is found, the Program Panel displays XIO 77, and the STOP indicator illuminates. The tape continues to run. To stop the tape, press the Recorder STOP switch.

4.4 Summary – Included here is a quick reference summary of commands to be used when operating the Digital Cassette Recorder with a PMC or Mini-PMC controller.

RECORDING PROGRAMS (PUNCH mode only)

1 – Set the Panel Mode Switch to PUNCH.

2 – On the Recorder press REWIND.

3 – On the Recorder press RECORD ON TAPE.

4 – When the tape stops, again press RECORD ON TAPE and on the Program Panel press [START].

LOADING PROGRAMS (READER mode only)

1 – Set the PANEL MODE Switch to CLEAR. While holding down [ALTER], press [START].

2 – Set the PANEL MODE Switch to READER.

3 – On the Recorder press REWIND.

4 – On the Program Panel press [START].

5 – On the Recorder press READ FROM TAPE.

VERIFYING PROGRAMS (READER mode only)

1 – On the Recorder press REWIND.

2 – Set the PANEL MODE Switch to READER.

3 – While holding down [ALTER], press [START].

4 – On the Recorder press READ FROM TAPE.

NOTES

Section 5
MAINTENANCE

5.0 Introduction – In instances when the Digital Cassette Recorder is not operating properly, it is recommended that users return it to Allen-Bradley for repair. (Refer to Publication SD15, Repair Exchange Policy.) It is further suggested that the local Allen-Bradley representative be contacted for information about forms which should accompany the equipment returned to the Systems Division. At very least, a statement of the problem should be included to aid the service personnel to determine the cause of the malfunction.

Users should not attempt to repair the Digital Cassette Recorder. Any attempt to service the unit beyond routine preventive maintenance may void the warranty.

The following paragraphs outline typical preventive maintenance procedures which can be easily scheduled and performed by users.

5.1 Transport Maintenance – The following preventive maintenance procedures will enhance the performance of the recorder and assure long-term, trouble-free operation.

5.1.1 Cleaning Heads – The read/record and erase heads should be cleaned after approximately 8 hours of operation. (Since this amount of actual operation may not accumulate for a year, or more, in normal applications, it may be a good practice to schedule an annual cleaning.)

The heads are located under the control panel in the transport well. It is necessary to open the smoked plastic cover and look in **and** back under in the direction of the push buttons. (Refer to Figure 21.)

In order to clean the heads, use a cotton swab dipped in a **small** amount of a magnetic tape head solvent which is made from at least a 90-percent isopropyl alcohol. (The manufacturer currently recommends MS-200, which is made by Miller-Stephensen Chemical Company [1], although equivalents are acceptable.)

Rub heads carefully in order to remove the build-up left by the magnetic tape passing over the surfaces. Then wipe dry the heads with other swabs.

Do not touch the heads with fingers or foreign objects.

5.1.2 Capstan – The capstan drive roller should be cleaned after approximately 16 hours of operation. (Refer to Figure 18.) Use the same procedure outlined in Paragraph 5.1.1.

5.1.3 Unit Cleaning – The external surfaces of the Digital Cassette Recorder should be thoroughly cleaned after approximately 100 hours of operation. An attempt should be made to remove dust, metal oxide particles, and accumulated lint. The use of a soft brush is recommended.

5.1.4 Demagnetization – The recording heads should be demagnetized after approximately 100 hours of operation. To accomplish this, slowly move the energized demagnetizer back and forth across the heads several times.

CAUTION: Do not touch the Recording heads. Scratches may affect the quality of the recording.

5.2 Cassette Tape – The Cassette Tape does not require preventive maintenance, as such. However, here are some practices which maintain the quality of the recordings and extend the life of the tape. For example, the surface of the tape should not be touched with fingers or foreign objects. The cassettes should be protected from dirt, excessive heat and stray electromagnetic fields. Before storing, rewind the tape to the leader portion. When not in use, the cassettes should be stored in closed containers, in a cool, dry place. Be sure the storage place is not near stray magnetic fields.

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[1] Miller-Stephensen Chemical Co., Inc.
George Washington Parkway
Danbury, CT 06810

Figure 21 – Read/Record and Erase Heads

NOTES

Section 6
SPECIFICATIONS

6.0 General — This Section is a listing of the specifications for the Digital Cassette Recorder as it is produced for Allen-Bradley. Note that the specifications for the Cassette Tape assume that a certified, computer-grade digital cassette is being used in the Recorder.

SPECIFICATIONS [1]

Power Requirements
120V AC (±10%)
60/50 Hz

Baud Rate
1200 Baud

Data Format
8-bit binary, serial
plus 1 start bit and 1 stop bit per character

I/O Interface
EIA RS-232-C

Transmission Mode
Full-Duplex, Asynchronous
Bit Serial

Tape Bit Error Rate [2]
Less than 1 "intermittent" error in 10^7 bits
Less than 1 "unrecoverable" error in 10^8 bits

Tape Recording Density
92,000 8-bit characters
on 1 track of 300-ft. tape

Recording Heads
Dual gap, single track,
Read/write with
separate erase head

Cassette Type
Cat. No. 1770-XA
or equivalent: standard
Philips-type digital cassette
with head pressure pad;
computer grade magnetic
tape certified at 1600 FCI
(flux changes per inch)

Size
6" x 14" x 18"
15.3 cm x 35.6 cm x 45.8 cm
(H x D x W)

Weight
19 lbs. (8.6 kg)

Operating Temperature Range
+10°C to +50°C

Storage Temperature Range
-40°C to +70°C

Humidity Range
5 to 95% R.H.
(without condensation)

Fuse
1A, slo blo 3AG
Bussmann MDL or equivalent

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[1] Refers only to models made for Allen-Bradley.

[2] When used in Recorder.

Section 7
QUICK REFERENCE COMMANDS LIST

7.0 General – This Section is composed of quick reference lists of Digital Cassette Recorder commands a user may use to refresh his memory when loading, recording or verifying programs with Allen-Bradley controllers. These lists assume that a user is familiar with the contents of Section 1, Introduction, and of the Section dealing with the particular controller being used.

CAUTION: Do not use these quick reference procedures unless you are familiar with the steps outlined in the Manual. These lists are reduced to a minimum, and, therefore, important background information has not been included.

7.1 PLC – The following is a quick reference list of commands used with the Bulletin 1774 programmable controller. (Refer to Section 2.)

RECORDING PROGRAMS (any mode)

1 – Set switch on Cable to VERIFY AND RECORD.

2 – Press REWIND.

3 – Press RECORD ON TAPE.

LOADING PROGRAMS (PROG mode only)

1 – Set Mode Select Switch to PROGRAM LOAD.

2 – Set switch on Cable to LOAD.

3 – Press REWIND.

4 – Press READ FROM TAPE.

VERIFYING PROGRAMS (any mode)

1 –Set switch on Cable to VERIFY AND RECORD.

2–Press REWIND.

3–Press READ FROM TAPE.

7.2 PLC-2 – The following is a quick reference list for use with the PLC-2 Processor. It may be referred to when using the Bulletin 1772 Program Panel or the Bulletin 1774 Program Panel. (Refer to Section 3 for specific procedures.)

RECORDING/VERIFYING PROGRAMS (any mode)

1 – On the Recorder press REWIND.

2 – On the Program Panel enter [RECORD] [0].

3 – On the Recorder press RECORD ON TAPE.

4 – On the Recorder press REWIND.

5 – On the Recorder press READ FROM TAPE.

LOADING/VERIFYING PROGRAMS (PROG mode only)

1 – Set the Mode Select Switch to PROG.

2 – On the Recorder press REWIND.

3 – On the Program Panel enter [RECORD] [0].

4 – On the Recorder press READ FROM TAPE.

5 – On the Recorder press REWIND.

6 – On the Recorder press READ FROM TAPE.

VERIFYING PROGRAMS (any mode)

1 – On the Recorder press REWIND.

2 – On the Program Panel enter [RECORD] [1].

3 – On the Recorder press READ FROM TAPE.

7.3 PMC – The following is a quick reference list of commands used with the Bulletin 1750 PMC and Bulletin 1755 Mini-PMC programmable controllers. (Refer to Section 4 for specific procedures.)

RECORDING PROGRAMS (PUNCH mode only)

1 – Set the Panel Mode Switch to PUNCH.

2 – On the Recorder press REWIND.

3 – On the Recorder press RECORD ON TAPE.

4 – When the tape stops, again press RECORD ON TAPE and on the Program Panel press [START].

LOADING PROGRAMS (READER mode only)

1 – Set the PANEL MODE Switch to CLEAR. While holding down [ALTER], press [START].

2 – Set the PANEL MODE switch to READER.

3 – On the Recorder press REWIND.

4 – On the Program Panel press [START].

5 – On the Recorder press READ FROM TAPE.

VERIFYING PROGRAMS (READER mode only)

1 – On the Recorder press REWIND.

2 – Set the PANEL MODE Switch to READER.

3 – While holding down [ALTER], press [START].

4 – On the Recorder press READ FROM TAPE.

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